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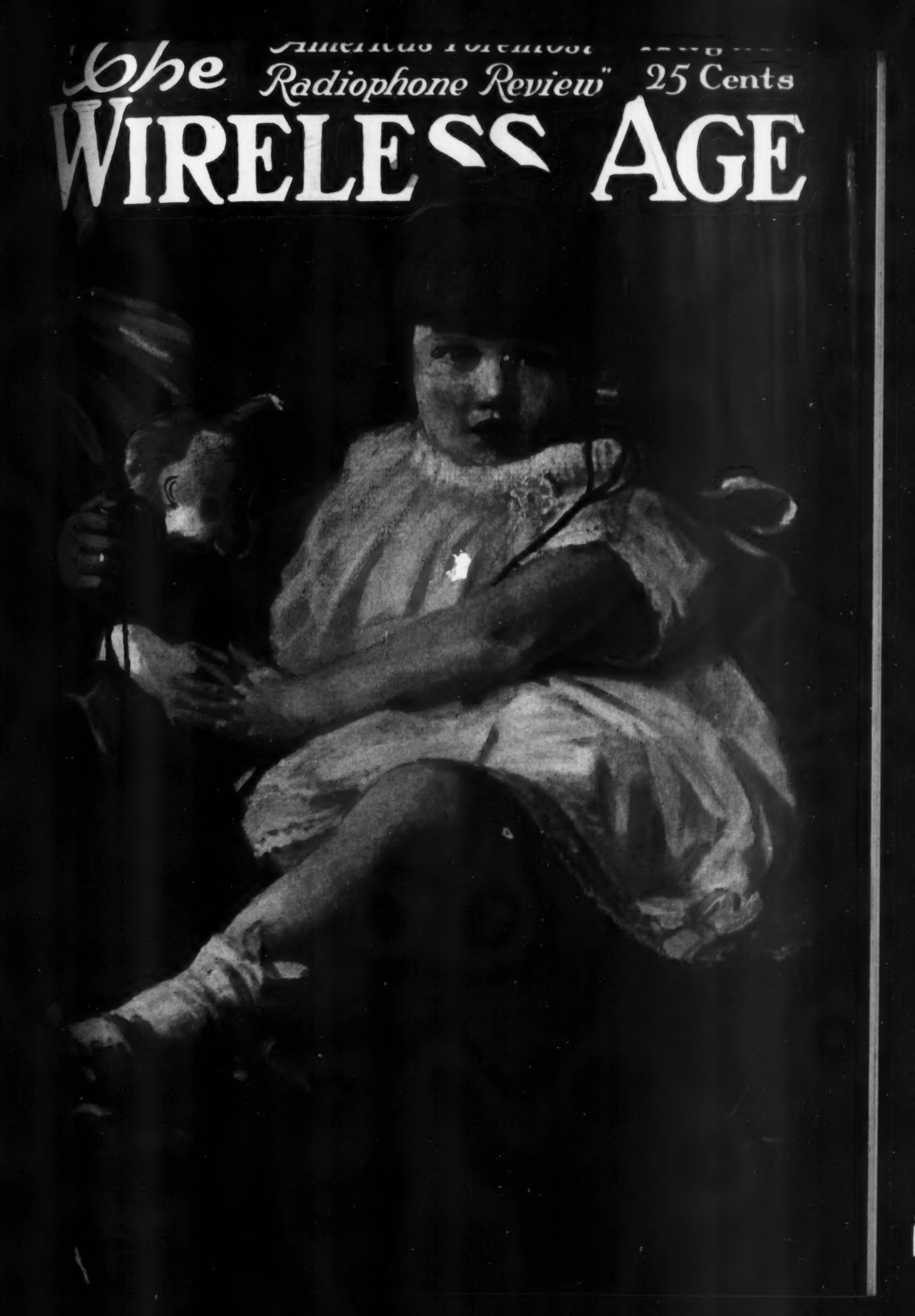

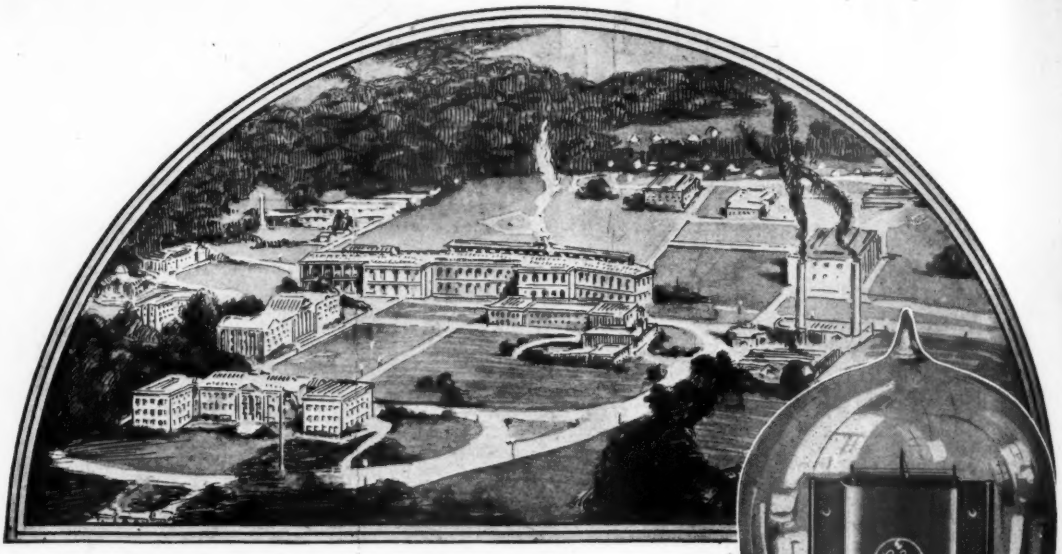

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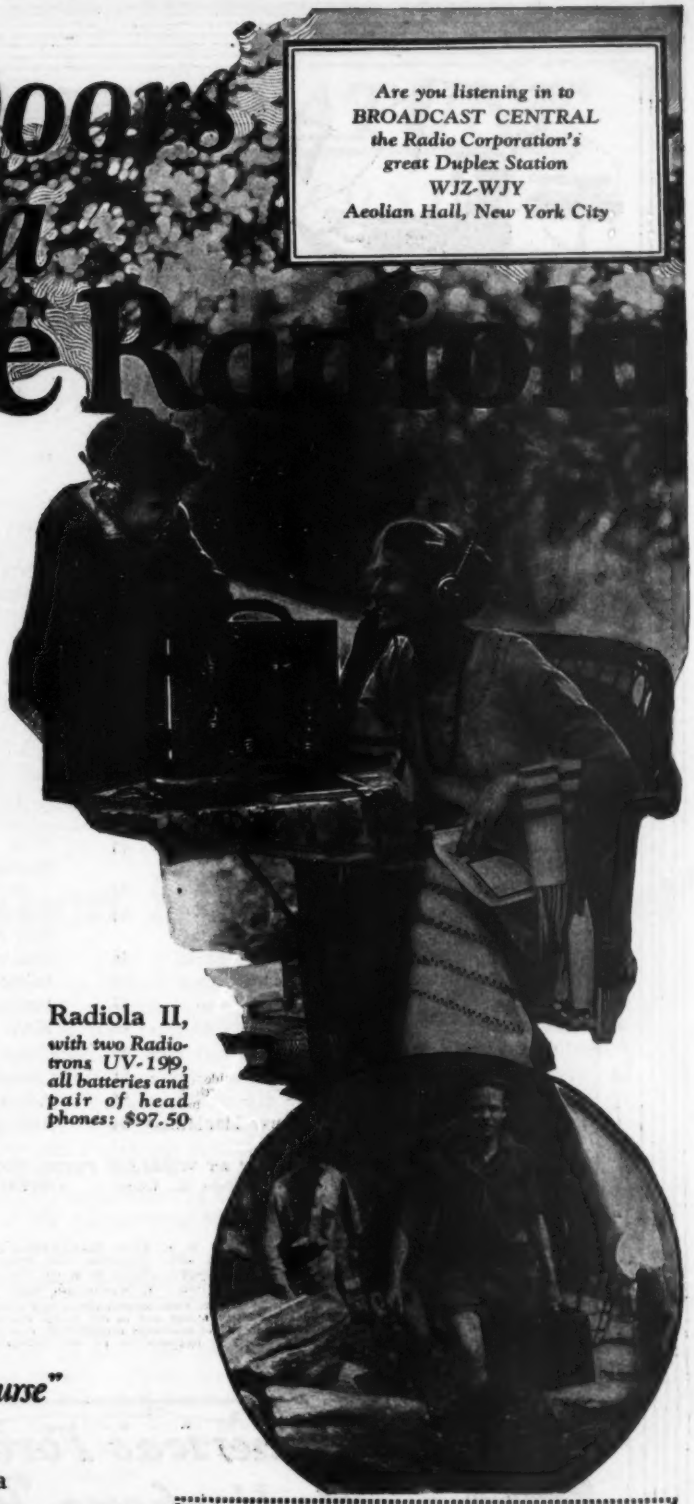

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Volume 10 *Edited by* J. ANDREW WHITE *Number* 11

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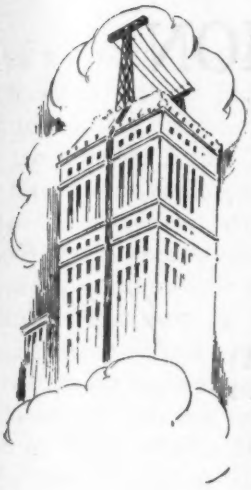

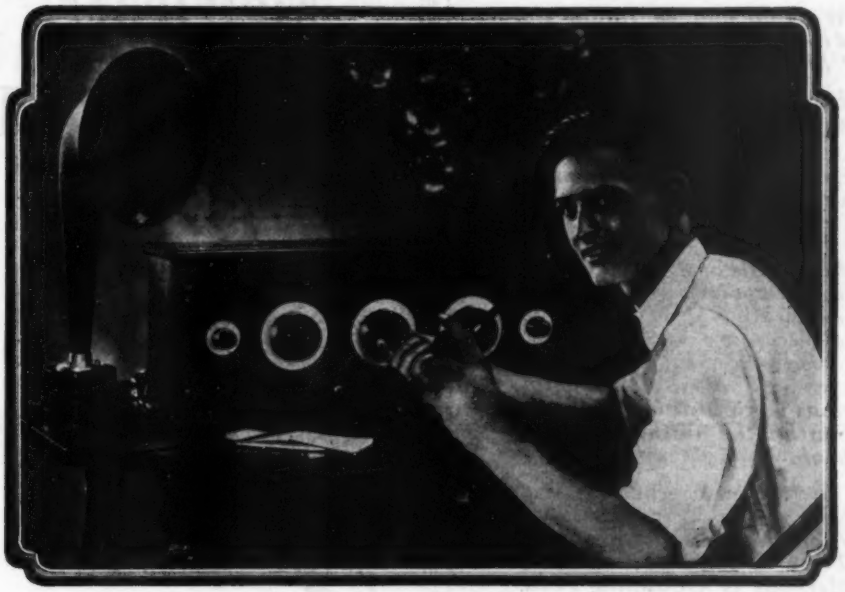

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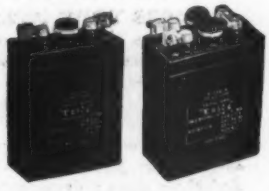

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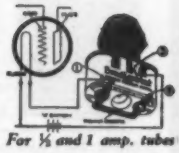
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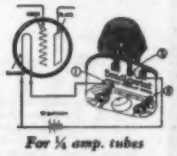
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Marconi on the Future of Wireless

GUGLIELMO MARCONI, in a signed article in the Nuvo Giornale of Florence on the predicted revolution in wireless communication, says:

"Eventually science will find a way of directing electrical energy without wires in an absolutely straight line. The result will be less expenditure of energy for short distances and hence less expense for messages. Once directive control has been established we shall undoubtedly be able by means of powerful machines to girdle the whole world with waves of electric energy without wires."

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"Very soon, too, that miserable ticking machine on which all newspaper offices depend will yield place to this mighty invention, which is suitable for news sending, news receiving and simultaneous communication with any number of receiving stations.

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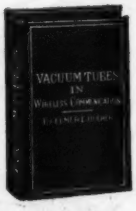

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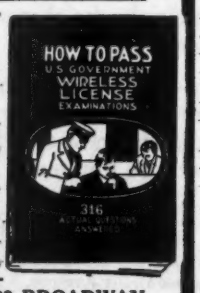

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Wireless Press, Inc.,
326-28 Broadway, New York.

Enclosed please find $.....for which send me the books checked below.

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	Vacuum Tubes	Bucher	$2.25
	Radio Telephony	Goldsmith	$2.50
	Radio Instruments and Measurements		$1.75
	Practical Wireless Telegraphy	Bucher	$2.25
	How to Pass U. S. Govt. Wireless License Examinations	Bucher	.75
	* The Wireless Age (one year)	With Book Order	$1.50
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This man knows Radio!

HE knows how to get the *best* out of his set. New hook-ups, new tubes, new parts—he tests them all and finds the best.

He was a wireless fan long before radio became the greatest indoor sport. Fifteen years ago he used Brandes. Today he still sticks to his Brandes Matched Tone Headset.

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Radio Headsets

MAGNAVOX

Radio in Summer

THE man who purchases a Magnavox for its clearness of reproduction, finds additional advantages in its use which contribute greatly to his enjoyment of Radio.

For instance, due to its extreme sensitivity, the Magnavox can clearly reproduce signals which otherwise would be indistinguishable.

This means a great increase in distance range—more stations brought within the Magnavox owner's reach.

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R2 Magnavox Reproducer with 18-inch curvex horn: the utmost in amplifying power; requires only .6 of an ampere for the field **$60.00**

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WHEN days are spent in summer's outdoor playgrounds, Magnavox needs only an instant's notice to supply dance music, sporting news or entertainment for all.

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MAGNAVOX Radio
The Reproducer Supreme

8R

A new battery charger, noiseless and indestructible

FANSTEEL BALKITE is a new metal developed for this charger. It acts as a valve, allowing alternating current to flow into the battery but not out of it. It is the most efficient charger valve made, is practically indestructible, and does away with noisy, delicate vibrators and fragile bulbs.

The Gould Battery Company is also marketing, under the Fansteel Balkite Patents, a complete battery and recharging unit known as the Gould Unipower, into which this charger, under the name, "The Fansteel Balkite Rectifier," has been incorporated.

The Fansteel Balkite Battery Charger for Radio "A" Batteries is an entirely new type of electrolytic rectifier, based on the use of Fansteel Balkite, a new and rare metal developed for this purpose. It does away with all noise, cannot deteriorate through use or disuse, has nothing to replace, adjust, or get out of order, cannot discharge or short circuit the battery, and requires no attention other than an occasional filling with distilled water. There are no moving parts, bulbs, or fuses. It will not overcharge, and cannot fail to operate when connected to the battery and line current. It is unaffected by temperature or fluctuations in line current, and will charge a completely dead battery. It is simple, efficient, and indestructible except through abuse.

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PATENTS APPLIED FOR *Battery Charger*

The Fansteel Balkite Battery Charger will charge the ordinary 6 volt radio "A" battery at 3 amperes, and a 12 volt at 1½ amperes, from 110-115 AC, 60 cycle current. It comes complete and ready for use. Get it from your dealer, or use the coupon below.

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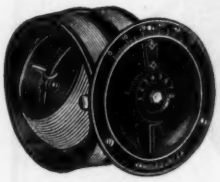
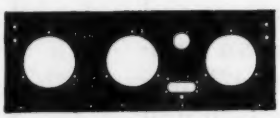
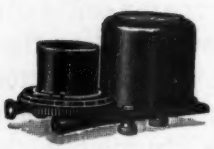
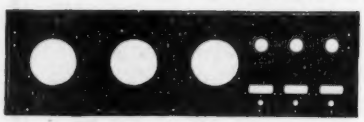
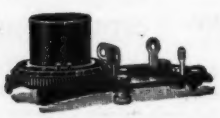


Speaking of Portable Sets—









AN ideal vacation set may be built with these units.

No special packing case is required, owing to the absence of protruding knobs and smooth surface of panel.

The concave dials, aside from adding attractiveness to a receiving set, increase its utility.

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THIS new dry battery for the "A" or filament circuits of dry cell vacuum tubes is a Burgess achievement which will not soon be forgotten.

Burgess has perfected a dry "A" battery which will give over twice the life, on vacuum tube service, of any ordinary No. 6 Ignition dry cell. It has a rapid recovery to high voltage after short periods of rest and practically no voltage lost when not in use.

This Burgess "A" dry battery will lead the "A" battery field just as the Burgess dry "B" battery has led in the field of "B" batteries. Ask any Radio Engineer about Burgess "B" Batteries.

Made only in single cell units. This makes it possible to wire up convenient combinations for all types of dry cell tubes, and eliminates the hazards and expense of multiple cell units.

Ask for the Burgess "A" Battery when you are equipping your new set or replacing your old dry batteries. Sold by all progressive radio dealers.

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These figures do not include radio stations established on shore and on vessels of the United States army and navy, nor include radio telephone and telegraph stations established on aeroplanes, nor stations established by the Postoffice Department and numerous other departments of the government. It has been approximated from reliable sources that there are over two million radio receiving stations in use at the present time throughout the United States.—From address delivered by Arthur Batcheller, U. S. Radio Inspector.

Think of the tremendous growth in this world wide industry! What is more—think of the great opportunities in this fascinating field! Positions are now open for the trained man-positions as a wireless operator on shipboard in the American merchant marine or with the radio manufacturing companies. Licensed radio men are in great demand.

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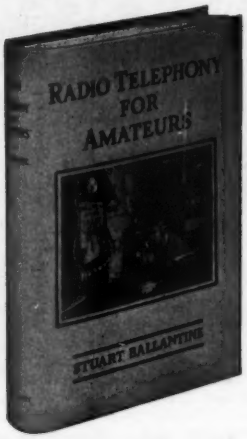
By STUART A. BALLANTINE

296 Pages—153 Illustrations

Here's a real practical book for the practical amateur. It contains no confusing mathematics, but just plain facts that cover every phase of radio communication. The book is chock full of information and suggestions for new things and new ways of doing old things, with instructions as to how to go about them.

The book includes Principles of Radio Telephony, The Vacuum Tube, Antenna Construction, Construction and Operation of the Transmitter, Sources of Power, Receiving Apparatus and other subjects.

This book offers enough suggestions to keep an experimentally inclined amateur busy for a long time. Copies ready for immediate shipment.



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The book was written for the novice and explains the theory and operation of vacuum tubes in clear, easily-understood language. There are many elementary diagrams and graphs which clearly show the proper tube hook-up for all purposes and with these diagrams is a plain-language explanation of necessary facts. To anyone not thoroughly familiar with the rules governing proper tube operation this little volume will prove a mighty helpful and satisfactory instructor.

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RADIO PHONE RECEIVING

Written by Nine Radio Specialists

While the joint product of nine of the most prominent authorities this book is one which can be read and understood by the layman. Big men were chosen for the job of writing this book as great ability is required to make dry theoretic facts understandable and interesting. As a result of the excellent work done by such well-known authorities as Prof. M. I. Pupin, Prof. A. N. Goldsmith, Prof. J. H. Morecroft, Prof. L. A. Hazeltine, Prof. Erich Hausmann, John V. L. Hogan, Frank E. Canavaciol, Robert D. Gibson and Paul C. Hoernel, this book will be enjoyed by the beginner and valued by the expert.

RADIO PHONE RECEIVING

Price $1.50

THE WIRELESS PRESS

326 BROADWAY, NEW YORK

Enclosed find.....for which send me

- ☐ RADIO TELEPHONY FOR AMATEURS
- ☐ VACUUM TUBES IN RADIO
- ☐ RADIO PHONE RECEIVING

Here's good news for the lovers of *REAL* RADIO MUSIC

HERE'S a new Audio Frequency Transformer that, on actual test, has shown that it gives greater amplification and greater fidelity of reproduction over the whole range of orchestral music.

From the slow rhythmic beat of the kettle drums (30 or less cycles per second) to the upper octaves of the piccolo (8000 cycles per second) every instrument in the orchestra and every note played by that instrument is reproduced more strongly, purely, faithfully than you had dreamed possible.

Install one on your present set. The result will be a revelation to you of what radio can mean in your home.

And the same engineering skill, based on twenty-three years' experience in the manufacture of communication apparatus, is behind every Federal Guaranteed Radio Product.

There are now more than 120 separate, individual Radio Products in the complete Federal line.

From head-sets to grid-leaks you will find each Federal product to be the best of its kind. You are *sure* of satisfaction. We *guarantee* it.

Send today for illustrated catalog, describing them fully.

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CONTINENTAL
"New York's Leading Radio House"

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Radiola II

Portable Set for Summer!

Here is a portable radio set which pleases every experienced user, and makes summer radio available to all.

It is light, compact and easily transported from place to place, yet ideal for home use because of its beautiful finish and appearance.

Distributors for the Radio Corporation of America

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In the woods, on the road, over the water, anywhere—Radiola II never fails to please its listeners

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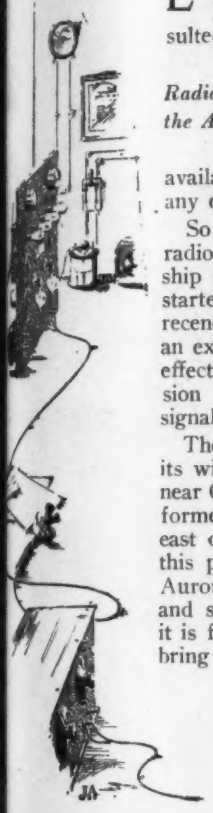
In Our Opinion



Radio and the Aurora

EVERY brilliant display of the Aurora Borealis, or Northern Lights, has resulted in a partial paralysis of land wire communication, particularly in the northern section of the United States and Canada. No definite information has ever been available, however, as to whether it had any effect on radio communication.

So special interest is attached to the radio installation on the *Bowdoin*, the ship of Explorer Dr. MacMillan, which started on its 14 months trip to the Arctic recently, for on this voyage there will be an excellent opportunity to determine the effect of the Aurora on radio transmission and reception, static, variation in signal strength and other phenomena.

The MacMillan party expects to make its winter quarters either at Flagler Bay near Cape Sabine or at Jones Sound. The former is located about 540 miles northeast of the magnetic north pole. From this point of vantage inside the circular Aurora the opportunities for investigation and study of the Aurora are ideal, and it is felt that the party on its return will bring with it much information of value concerning the effects of the brilliant lights of the North on radio communication concerning which very little or nothing is known at the present time.

* * *

Programs That Are Almost Ideal

BROADCASTING is referred to constantly as a public service. That is its aim and its function, with the additional distinction of filling spiritual and economic needs in a manner which no other medium can replace.

What the radiophone has accomplished in the short span of two years of actual service in this field has no parallel, for now there is scarcely a village or hamlet in the length and breadth of the nation so isolated that the tube-equipped receiver cannot bring it in touch with the centers of civilization. Half a thousand transmitters and millions of receivers are the constituents of this great network, and a sizeable percentage of the entire population is engaged in the fascinating twisting of dials which brings to the home—gratis—information, culture and entertainment.

What does this great public want in these three classifications? The question has been asked innumerable times. And the answer seems to be: Just about what it is getting!

How close to satisfaction are the present day broadcast programs is disclosed in an article in this issue. The listener has spoken, expressing his preference by means of 69,500 ballots which this magazine issued to provide an easy means for registering desires as to the "Ideal Program."

Only a few minor adjustments are needed in the proportions of operating hours allocated to music and speech, and the needs of the articulate radio fans will be met in full.

It is a fair assumption that these adjustments will be immediately effected, for broadcast station managers who have come so close to sizing-up the listeners' preferences in the past may be expected to do a 100 per cent. job with this additional guidance.

For if broadcasting is a public service, the program managers are public servants. And highly efficient ones, too, as this interesting balloting has disclosed.

* * *

Radio's Aid to an Older Industry

RADIO sells phonograph records, say the majority of musical instrument retailers. So the question of the newcomer injuring the old timer is once again answered in the usual way—the new and popular invention stimulates the established industry by expanding its field of influence.

In previous issues of this magazine, the disc manufacturers' attitude has been expressed, and the player piano people have had their say. They were favorably disposed toward radio. The last link in the chain has now been forged by the article in this issue which gives the retailer's viewpoint. More than three-quarters of those who reported to THE WIRELESS AGE look upon radio as something that has helped their sales—which, as a matter of fact, comes as not a bit of a surprise to the radio listener. Fans are good buyers of records; and they know it. Any feeling of consternation or panic within the canned music industry has arisen solely among those who have had no experience with the great indoor (and outdoor) sport of listening-in.

A prediction seems in order.

Today, a concert artist seeking to book dates for a tour receives lots more favorable consideration from local managers if he or she is known to the public through phonograph records. It will not be long before the question will be expanded to: How well are you known to the radio audience?

It is human nature to want to see a celebrity. Great crowds gather merely to look upon persons who have won public favor, whether their field of endeavor is music, statesmanship or athletics. Nothing is more certain than that the desire for personal contact which will be aroused in the listener when any particular individual has inspired or entertained to an unusual degree over the radio.

And awaiting the opportunity for a view of the actual person who has ably entertained, the phonograph disc or the player piano roll, with its permanent record (and the opportunity for endless repetition of the talent of the performer) has an attractiveness which is certain to bring forth dollars in endless stream from the pockets of radio listeners.

—THE EDITOR.

ALICE MILLS, the popular rising young movie star, spoke over the radio recently, and when she had said "Good Night" she suddenly remembered she had forgotten to mention a brilliant idea of hers. You will read about it in an interesting interview on page 32

Intimate Glimpses in Broadcasting Studios

Margaret Nikoloric, American pianiste, whose playing reproduces extraordinarily well by radio, explains why on page 35

Giuseppe Danise, baritone, Metropolitan Opera, tells in an interview on page 34 how glad he is to broadcast, and what great service radio does

Belle Bart, astrologist, has the honor of drawing more mail from radio audiences than any other current speaker in the Eastern States. Page 33 tells you why she is so popular

Radio's Varied Offerings Fill All Outdoors

When tired of the watery waves of the sea, Mimi Palmeri beaches her canoe and sails happily away on the radio waves

Fishing—fishing for fish and radio concerts. It's only a crystal set, so we suppose the broadcasting station is nearby, for the smile says the music is great

Della Vanna is a favorite with the audience of KFI, Los Angeles, which has broadcast her a number of times. For relaxation after a hard day at Hollywood she listens-in for KFI like this. The station, which is operated by Earl C. Anthony, is a powerful one and that's why Della uses a crystal set to enjoy the local programs

This fan is a wise young bird, for 'way last Spring (see the bare trees?) he had his automobile all fixed up like this, with receiver and loop mounted on the dash, and since then he has been seen on the highways and byways here and there, picking up local and DX programs

Radio Carries Gifts to Many in Many Places

"Gimme a lissen? Will yer?" and John Novak let Francis Lyons hear the dance music. They are two of the host of New York's cripples, but they like radio fine for all of that

This will recall, to Signal Corps men and gobs alike, many a back-breaking hour at the hand generator. This time it is an experiment with radio communication with an under-sea diver

Vincent MacIlvain is two years old and already has learned to tune his daddy's receiver. When he's at the dial, music comes, not bedtime stories. He must be listening to the Angel's Serenade

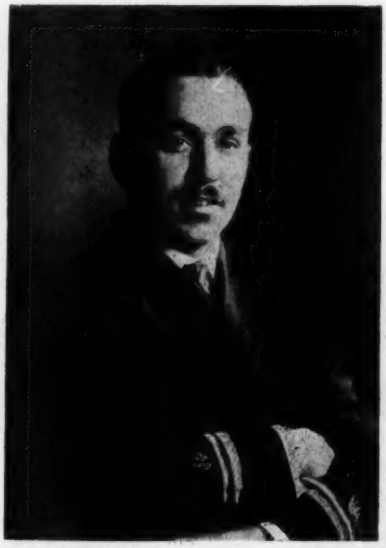
How'd you like to be the "Old Soak?" Harry Beresford, who stars in the play of that name on Broadway, has taken on radio to cheer him up. Really, now, anybody who ever had a friendly feeling for liquor—don't know whether Harry has or had—can't help feeling sorry for the Old Soak who has to act like one but not be one. The set in the theatre wings maybe cheers him up between the acts

"Go bi bi? Go bi bi?" says mother, and daughter cries loudly: "Skillibooch! Guggle uggle squeefa!" which, being interpreted, means: "You betcha! I'm just so excited I can't keep still!" And you'd be excited too, if your kiddie kar had an Ace radio receiver, antenna and all, attached to it, so that you could hear the local stations while bi-bi-ing up and down the long, long front porch

Voices You Have Heard

Announcers, Artists and Studios

George S. Cruger, concert announcer for WOO, Philadelphia, on the air



E. J. Martineau, director of KPO, Hale Brothers, San Francisco, in his sea-going uniform. He is an "old timer," having pounded his first key in 1907. As radio officer during the war he sent about twenty-five SOS calls during attacks by enemy submarines. It is the radio audience that does the calling now: "Send out your program"—and he does, to everybody's delight

Miss Mary Vogt, who plays the great Wanamaker organ that Station WOO, Philadelphia, makes audible to so many thousands of homes

"Radio KPO, Hale Brothers, Incorporated, San Francisco, The Metropolis of the Golden West, signing off. Good Night, Friends of the Air," is the way this studio closes its program. DX hounds to the east and west eagerly hunt for the wave from KPO every night—and find it, too, even on the Atlantic Coast and out in the middle of the Pacific

Yes, the Radiofan Buys Records!

Talking Machine Dealers Say Broadcasting Assists Their Sales—Some Find It a Hindrance in Selling New Talking Machines

By Ward Seeley

Far-Sighted Merchants Look for Combination Radio Set and Phonograph as Profitable for Both Industries and for the Public

THE broadcasting of music is selling records of that music, and radio thus is making profits for the phonograph industry. Radio has even led to the purchase of talking machines for some homes that were without music until radio brought it to them. Radio is the most valuable assistant that the music industry has ever had.

These conclusions are drawn from an investigation by THE WIRELESS AGE among the phonograph dealers in all parts of the country. Painstaking interrogation of the dealers was conducted by members of the magazine's staff in person, and by means of a questionnaire sent through the mails. The great majority of phonograph dealers who replied to the questions find that radio sells records for them. People come into their shops continually to buy records of compositions to which they have been introduced by radio. They want to be able to play these numbers at will, and know that the only way is through the phonograph and player piano.

Seventy-six per cent. of the dealers reporting to THE WIRELESS AGE say that radio sells records for them. Some state that the radio fans buy records without demonstration, saving from five to seven minutes of time in each sale.

Estimates of the number of records thus sold run all the way from "several" to "150," even to "hundreds," and one man says "1,000." One dealer says his sales of discs have increased 20 per cent. because of "radio demonstration" of popular numbers. Another sells "10 a week" to radio fans. The most astonishing figure is a "75 per cent. increase."

And 30 per cent. of the reporting dealers handle radio sets as well as phonographs and musical instruments generally.

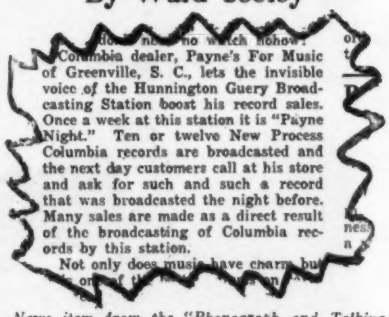
This, then, is the answer to the question that arose when THE WIRELESS AGE disclosed in its June issue the fact that the Victor and Brunswick companies were forbidding their exclusive artists to broadcast. Though both companies gave satisfactory and logical explanations of their attitude, and denied explicitly that radio was doing any injury to their business, still the Man in the Street might well have figured that some business effect (presumably an unfavorable one) must be behind the attitude of the disc manufacturers.

It is now evident that there is nothing of the kind below the surface.

Not that the phonograph dealers are unanimous. They are not. Nor, as a whole, have they displayed violent concern one way or the other. There are about 15,000 phonograph dealers, and THE WIRELESS AGE mailed its questionnaire to 7,500 of them, in all parts of the country. Just 317 of those dealers filled out the blanks. From which it does not appear that the dealer body as a whole is very much exercised about radio's possible harm, nor particularly alive to its immense benefit.

Yet almost without exception the 317 replies showed exceeding aliveness in one respect or the other. Where alarm was expressed many of the panicky ones convicted themselves of illogic in their own handwriting.

For instance, the questionnaire asked this: "When you balance sales lost through radio, against sales gained



—*News item from the "Phonograph and Talking Machine Weekly"*

The livest phonograph dealers are making money directly from radio, as well as indirectly. Wanamaker's, New York, now offers this Victrola with a special Paragon receiver built in it, and is selling the combination, on instalments if desired

RADIO AND THE PHONOGRAPH DEALERS.

76% report that radio sells records for them.
24% say either "no" or nothing.

100%

—

Admitting that radio's effect is both good and bad,
23% think that the net result is a gain (A)
33% think they see a loss (B)
11% make it "fifty-fifty" (C)
33% don't know what to say (D)

100%

(A) 43% of the dealers reporting gains sell radio apparatus.
(B) 27% of those who think phonograph sales are less also sell radio apparatus.
(C) 35% of those holding the "fifty-fifty" attitude sell radio apparatus.
(D) 22% of the dealers who have no definite convictions also sell radio apparatus.
30% of all dealers who returned the questionnaire said that they sell radio goods as well as phonographs.

—

The above figures are taken from 317 blanks returned out of 7,500 mailed, covering half the phonograph dealers in the country. Less than ½ of 1 per cent. of the dealers showed sufficient concern over the subject to reply to the questionnaire.

Landay Brothers, New York phonograph dealers, operating a chain of stores, sell Radiolas as well, so much down and so much a month, and are building up a nice trade. The firm also presents occasional "Landay nights" via WJY

through radio, what is the net result, a gain or a loss?" That was the real keynote query, but the very first replies received showed that they would have to be considered in the light of the answers to the question: "Do customers buy records that they have heard by radio?"

Of the 317 dealers, 105 said that they thought radio meant a loss to them. But 87 reported that radio sells their records. And very few of the 105 losers could give any definite figures in reply to the question as to how many phonograph sales radio had cost them. One man wrote: "50 and perhaps more"—just after having stated that he had sold 1,000 records as a result of radio demonstrations. He concluded that the net result was a loss! Most dealers estimated the lost sales as "several," and "about five or six," and "five, temporarily," and "lots," and "some," and others used similar indefinite expressions. Many left the blank vacant, and a few wrote: "No way of telling."

It was a natural assumption that the phonograph dealers would know when or if they had lost business. Apparently they do not. This branch of the music trade as a whole, while it knows the volume of business it does, has no way of ascertaining how far it falls short of the maximum possibility. In other words, it appears that the talking machine retailers have not yet learned to establish quotas for themselves and try to reach them, nor do they know definitely who their prospects are.

Joan Jarvis is a modern maid—she takes her portable receiver in her canoe. Some phonograph dealers look upon such diversions as this with alarm, but many (see specimen questionnaire reproduced below) know that Joan will come tripping into their shops to buy records of compositions she has heard over the air

Remarks were much more voluminous than reporting of the actual figures. Most of the 317 had something interesting to say, and astonishing enough, nearly every case showed a favorable attitude toward radio even when the questionnaire revealed that the dealer considered that it had caused him a loss. A few evidently felt that, "Well, we have lost money through radio, but gosh, ain't it great!"

There were instances where those who felt that radio had brought them new business could not find words enough to express their appreciation. One man who reported that he was selling about ten records a week to people who had heard them played by radio, and was saving an hour a week in demonstration time, wrote: "Believe that radio will become a part of our business. We have considered it for about a year." Another man, 3,000 miles away from the first stated, "We have not found that the radio conflicts with the music department at all. In fact we have combined the two, and both have made a good showing." Another firm, the Van de Walle Music Co., Seymour, Ind., while not giving any definite figures as to records sold, writes this regret into the questionnaire: "Sales

---

We took on radio, feeling that we must have both it and the phonograph or get left. Many people at this time who were prospects for the phonograph have their mind headed toward a radio set first "when they get them perfected." The phonograph must wait for that radio set unless they chance to hear one under poor conditions and decide on the phonograph from that hearing.

Knowing the supreme qualities of the New Edison as we do, we believe any owner of a radio set, especially if experienced in reception, is sure to appreciate more the superiority of the New Edison as a perfected musical instrument. In other words, the average prospect is bound to have radio. Then we had better have his order if we can get it. Without radio we lose him. With radio and phonograph, he knows we are not prejudiced and we probably can have his radio business. After he has had about twenty nights on his set, heard Charlie Kerr's orchestra and others, become familiar with some fine violin solos of which he has heard but the last part; listened to the last few notes of a song by Anna Case, perhaps, and put up with the numerous disturbances which at times are a part of radio,—then and then only, will he understand and appreciate what Mr. Edison has done for him by giving him complete renditions by great artists at their best—and exactly as good as they are or as real as radio can give to him.

This all means that eventually he will have both radio and Edison for music in his home. I do not feel that the two conflict at all. However, it is going to take the radio to prove the qualities of the phonograph as well as to prove the exceptional qualities of the Edison among phonographs. The phonograph, as I tell my people, is comparable to a fine book while the radio is the newspaper. A man buys a book to read and preserve in his library for fnture reading by himself or by others. He buys the newspaper to obtain the "news"—something he doesn't know about. He would drop yesterday's newspaper like a hot brick the moment he recognizes that it is an old one. He selects the book to cherish and keep. With this vital difference, we feel that the phonograph will hold a stronger place than ever when the exact status is understood—but it must be an Edison, for radio is going to point out the limitations of the "talking machine" with its mere shadows of the original qualities of musical excellence as no other thing ever has.

Relative to your question about purchase of records by hearing radio renditions, I believe I am safe in saying that it must be so. While we have made no tests or tabulation as yet, the principle is fixed by experiences in records and sheet music. One group of people hears something new at a dance and immediately the sheet music sells. A new song is heard at a vaudeville show and the sheet music goes like hot cakes. Presumably records will be in the same class related to radio reception if one has a phonograph.

FRANK A. FRENCH,
The Studio Shop, Manchester, N. H.

IS RADIO HURTING OR HELPING YOUR BUSINESS?

Some phonograph dealers think that radio hurts the sale of records. Some think it helps them. Which does it do in your case?

This is a vital question that concerns both the talking machine and the radio industries. Everybody wants to know the correct answer. We are preparing a magazine article and ask your cooperation for first-hand information and your viewpoint.

Will you tell us in the blanks provided below? When the reports are all in, we will tabulate them, and print the totals in THE WIRELESS AGE. The totals will also be supplied to the talking machine trade papers, and to the press generally.

They will answer the questions whether or not radio is injuring the phonograph business.

Please fill in the blank promptly so as not to delay matters.

Thank you.

J. Andrew White

EDITOR THE WIRELESS AGE

Do customers buy records they have heard by radio? Yes

How many records have you sold in that way? Quite A number

Are such sales made with or without demonstration? Some are & some ask to hear the

If without, how many hours of selling time have you saved? No attention paid to this

What class of record is most in demand by radio fans? Mostly classic records

Do you know of any definite cases in which radio has prevented the sale of a machine or records? POSITIVELY NOT! How many? .....

When you balance sales lost by radio against sales gained through radio, what is the net result, a gain or a loss? GAIN

What makes of talking machines do you handle? SONORA EXCLUSIVELY

What makes of records? Okeh & Odeon

Do you sell radio apparatus, and if so, what makes? NO

What other merchandise do you handle? Phonographs & Records ONLY

Remarks Personaly I think the radio will help the phonograph & record business more than anything else.

May we quote your remarks in THE WIRELESS AGE? Yes ☐ No ☐

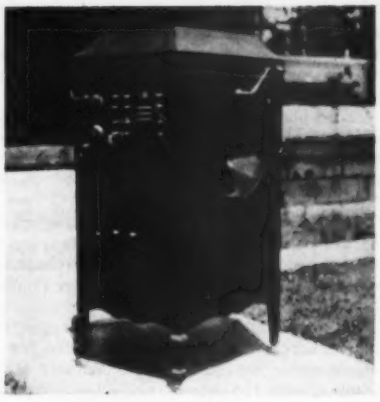
Dealer's Name J.A.Schillinger

Address 716 N Salina St. Syracuse N.Y.

Please Mail to The Editor
THE WIRELESS AGE, 326 Broadway, New York City

Gaze upon this happy family and then upon this dual machine.

The portable Sonora takes man's magic music to the fields, in the form of discs; the combination talking machine and radio set, made by Paul G. Wood, Hilliard, Ohio, is a promise of the future when both instruments shall be contained in the one case, portable or not



of records have fallen off considerably since broadcasters are not sending out the new popular stuff on account of tax. Cannot understand publishers' attitude."

The contention of the radio interests and of a number of phonograph company executives that radio broadcasting forms a gigantic demonstration is fully borne out by the Edison shop in San Francisco, which, like most Edison dealers, handles machines and records of that make only. "This shop averages one record a day sold by radio, and even attributes the sale of some Edison machines to broadcasting. Owners of other makes of phonographs hear records in this shop that they have heard by radio and they have disposed of their old machines and purchased Edison," reports the shop.

Not so definite, but none the less certain, is a man in Portland, Ore., who reports: "I think that radio is really a benefit to the phonograph trade because it stimulates interest in music." The American Furniture Co., Denver, Col., thinks that "all great popular inventions help other things and injure none. We are glad we have a radio as well as other useful things."

The Quackenbush Co., Paterson, N. J., estimates that its record business has been increased $75 per month by radio. The manager of this establishment writes: "Personally, I do not believe that radio has hurt the phonograph business to any great extent if at all. True, there are certain persons who do not buy a phonograph or records because of the ownership of a radio outfit, and there are also a great many people who do not buy one because they have an automobile or something else upon which they are devoting their time and money until the novelty wears off, so why pick on the radio, and blame it for any dullness (if there is any) in the phonograph industry? Can anyone go back into the history of music of any age, and find an equal condition to compare with the present status of music, as a form of entertainment to be enjoyed at home, a condition brought about by the radio? The radio fan gets what he gets when he is getting it. The phonograph fan gets what he wants when he wants it. There is no comparison; I think the radio is on the whole an asset to the music dealer, especially the phonograph dealer. But I also believe that the combination of the phonograph and radio will be the future merchandise of both lines. Radio has its own wonderful field to work in, but phonographs will still be playing when the present hysteria in the minds of some phonograph dealers will be only as a nightmare, gone and forgotten."

A firm in Indianapolis, Ind., reports that "the broadcasting of phonograph records is a great help to the record business. The dissemination of music in any form is a help."

"Personally I think the radio will help the phonograph and record business more than anything else," says J. H. Schillinger, Syracuse, New York.

"One thing that hurts our line is the cheap automobile," says a dealer in Seymour, Ind. Not much agitation over radio there! Henry Ford has not yet expressed concern about either phonograph or radio.

"Radio is not replacing phonographs, but is simply a new branch of the music business and should be handled as a musical instrument."—Burbank Music Co., Burbank, Cal.

"The radio has put the phonograph on the hum in our community," reports a firm in Morrison, Ill., adding that between 200 and 300 records have been sold as a result of radio broadcasting, and from twenty-five to thirty hours of demonstrating time saved.

That the market for talking machines is approaching saturation is the opinion of a dealer in Ft. Wayne, Ind., who writes: "After selling talking machines during a period of harvest days for same, we almost feel that the whole world is supplied with talking machines. Rather than the radio will injure the record business, I am inclined to think it will be a stimulant. I feel that we are going into a washing machine age as most homes have been equipped with a musical instrument for many years. Housewives gladly do the family washing in the old-fashioned way in order to have music in the home."

While most of the dealers who replied to the questionnaire reported that the loss, if any, was experienced in the sales of machines, while the gain was in records, one firm (which requested that its name be kept confidential) stated that radio was retarding the record business, but increasing sales of phonographs to owners of radio sets. This was the only report of that kind in the entire lot.

"We own and operate our own broadcasting station, KFFB," reports the Jenkins Furniture Co., Boise, Idaho. This station operates on 240 meters and thus is able to use phonograph music, and the brief statement is made that the company has sold numerous records as a result of its broadcasting operations. It is a Brunswick dealer.

"Do not think that the radio will hurt the record business until the time comes when you can hear what you want when you want to hear it," says M. T. Boulger, Lowell, Mass.

F. N. Ramer, Rockford, Ill., surveys radio with a contented eye, saying, "We have had twice the business this year as compared with the first five months last year," and adds, "those who have phonographs and become regular enthusiasts buy a radio outfit, but still keep their phonographs. From our observation, those who do not own phonographs and buy a radio outfit never had phonographs in their homes."

L. J. Haberhorn, Chatsworth, Ill., sells both phonographs and radio apparatus and says: "Quite a few prospects for players or phonographs say they will now buy radio, so when we lose a customer on a musical instrument we sell them a radio." Haberhorn handles Edison records and machines and DeForest and Paramount radio apparatus.

NOW as to the objectors, some of them more conscientious than well-informed. The preceding questions have been taken from the replies of dealers who stated that radio has either meant a gain or an even balance for them. What follows will come from the other side:

First, it is most interesting to note the general feeling of uncertainty among the phonograph dealers who think that radio has brought them a loss. Nearly every dealer who said that radio helped sales added extended explanatory remarks, but analytical extra comments of this kind were less frequent on the blanks reporting a supposed loss.

The one most frequent entry under the head of "remarks" was a suggestion that the phonograph people make a combination talking machine and radio set, this suggestion occurring eight times. The next most frequent idea was that the injurious effect of radio on the business will be but temporary.

"Now is the logical time for a talking machine and radio combination cabinet."—a dealer in Kenton, Ohio.

"I would like to see cabinet sets marketed through the established music dealers, better discounts given and some protection afforded. I am doing fine with Radiola IV and Grands."—R. Montaluo, Jr., New Brunswick, N. J.

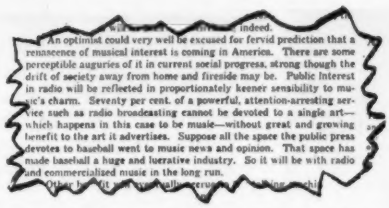
Another dealer in the same city, who did not want his name used, writes: "I am afraid that the music dealers will have to put in radio, as they can be sold without any more overhead."

"The phonograph industry should in our opinion endeavor to manufacture a combination machine even though prices may be much higher."—I. Jay Trubin, Red Bank, N. J.

"Believe the effect to be only temporary or until the novelty wears off. Many such buyers are drifting back to the purchase of records."—J. Ellis, Stapleton, Staten Island, N. Y.

Quite a number of dealers who regretted the influence of radio were decidedly pessimistic about the phonograph business as a whole, some of them evidently habitual lookers on the dark side. A Brooklyn dealer scribbled this lament: "The great trouble is that talking machines last forever and never wear out, and so do the records. An automobile is only good for a few years, but not a phonograph, which is everlasting."

A Boston phonograph dealer, whose desire for anonymity is hereby fulfilled, has a little advice to his fellow dealers who may feel as he does that radio is injurious. This is what he says: "Our total business has shown an increase of over 25 per cent. over 1922. Without our radio department



An optimist could very well be excused for fervid prediction that a renascence of musical interest is coming in America. There are some perceptible auguries of it in current social progress, strong though the drift of society away from home and fireside may be. Public interest in radio will be reflected in proportionately keener sensibility to music's charm. Seventy per cent. of a powerful, attention-arresting service such as radio broadcasting cannot be devoted to a single art—which happens in this case to be music—without great and growing benefit to the art it advertises. Suppose all the space the public press devotes to baseball went to music news and opinion. That space has made baseball a huge and lucrative industry. So it will be with radio and commercialized music in the long run.

—Editorial from "The Phonograph and Talking Machine Weekly

our business would have shown a decided decrease compared with 1922. This is some indication as to what radio is doing to the sale of talking machines and records."

A most confused state of mind is indicated in the reply from a large phonograph dealer in an eastern city, who also happens to be a music publisher. This firm started by admitting that radio sells records in its retail phonograph department, attributing 5 per cent. of its sales to such demonstrations. Then, to the question of injury to the sale of talking machines themselves, the reply is made that "the question is not fair," that radio "never gets to the point of stopping an actual sale—there is a great deal of general talk against the sale of talking machines which must have some basis." The company's phonograph business registers a 50 per cent. loss, according to the next question, and the appended comment ends: "The talking machine business here has decreased badly—we have excellent broadcasting stations!" Indicative, this one, of a bad case of fright without much reasoning having been indulged in.

In fact, quite a few of the dealers who were decided in their reports as to loss beat themselves around the bush by admitting in the Remarks something like this, quoted from a dealer in Newark, N. J.: "Once in a while some of our ex-customers who have become radio fans come in, if they expect company or if they have heard a special record that appealed to them." This dealer estimates that 10 per cent. of his record sales are made to radio fans without demonstration.

A very shrewd observation came from the Okmulgee Furniture Co., in Okmulgee, Oklahoma, which thinks that radio has meant a "loss, but think we can overcome it. We find people do not realize the value of the radio and phonograph combination yet."

"In the final analysis radio makes very little difference one way or another. Of course any new invention presented to the public and which demands their money, injures to some extent almost any other business, especially the non-essentials."—Beal & McCarthy Music Co., Brockton, Mass.

Player Piano Roll Maker Gets Excited in Print

and Is Told of His Mistakes by a Radio Maker and Broadcaster

RADIO is terrible, simply terrible. It's a bull in the music shop. So thinks Arthur A. Friestedt, president of the U. S. Music Co., Chicago, which makes player piano rolls of popular compositions. Friestedt thinks radio hurts nearly everything and everybody musical. Here are the main points in a long screed of his, which he forwards with the comment that it was recently published in a music trade paper:

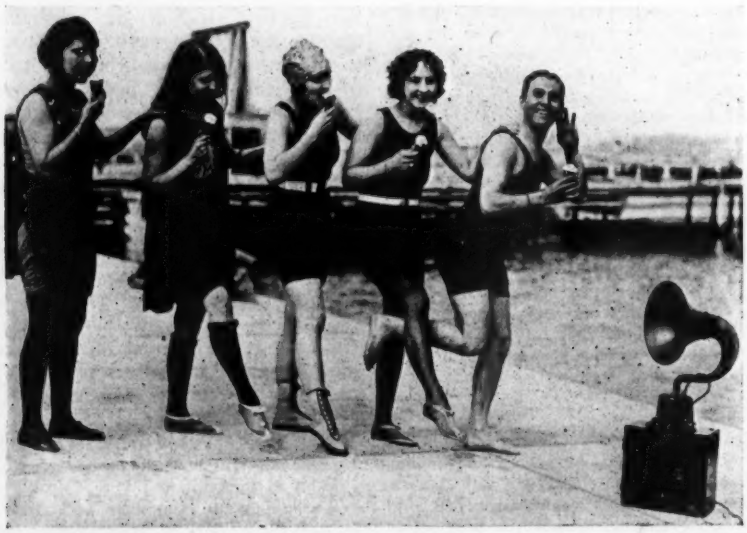
I am opposed to the radio broadcasting of music, especially the popular variety, for the very good reason that the practice is inimical to the welfare of the record and roll trade and, by no means last, the talking machine and player industry. When radio fans in the larger cities can hear solid dance programs played by the foremost orchestras with a $5 outfit, it is only reasonable that they should ignore their player or talking machine, even if the rolls and records were supplied them gratis. Other forms of free public music are necessarily insignificant when compared with radio broadcasting. * * * I wonder how long radio broadcasting would continue if they were obliged to pay from 7½ cents to 12½ cents for everyone who "listened in," as roll manufacturers do in the instance of every roll that is manufactured, whether it is sold or not? * * *

Music publishers who permit the broadcasting of their compositions gratis do so without regard for the consequences. In the majority of instances these publishers are among the smaller ones, who seek a cheap form of publicity in the hope that it will stimulate a demand for their sheet music and develop revenues from mechanical reproducers. These publishers will not be long finding out that at the best they will be no better off through radio broadcasting than they were without it; they will learn to their sorrow that the demand for their sheet music has been stifled instead of stimulated, also that their mechanical royalties will be nil. It is an old adage that "what costs nothing is worth nothing," and these publishers will learn that this saying is just as true in radio broadcasting as anything else. * * *

I do not decry the radio and I again reiterate that it can function splendidly in other fields of endeavor, or when its motive is to provide something for something, instead of something for nothing. * * *

I strenuously object to paying for what others can obtain gratis, for the simple reason that I have not a fair chance with the other fellow. I am not afraid of the radio if they will pay our prices for the materials they use. * * *

That radio broacasting not only cheapens but destroys the commercial value of any-



Zena Keefe, Alice Mills, Sara Mullen, Lucy Fox and Eddie Buzzell, footlight and film celebrities, go to the beach for a radio-accompanied rehearsal. Zena looks worried about her cone, and some phonograph dealers are alarmed by the whole thing, but the wise ones grin in pleasure

thing that is disseminated is a foregone conclusion. The radio fans who condemn the owners of works of value for refusing to have these broadcasted without compensation represent the majority of such enthusiasts, and it cannot but follow that their wails have none other than a financial aspect. Who wouldn't complain of paying for what previously had been obtained free? I cannot conceive how they can be angry with such publishers, simply because the absence of their particular compositions leaves them in the dark as to what to purchase in sheet music, rolls and records. * * *

THAT finishes with Friestedt. Here is a reply to him, written by E. F. McDonald, Jr., of the Chicago Radio Laboratory, and quoted also in part:

Motor cars affected the sale of the carriage, the buggy, the wagon and the bicycle. Player pianos affected the straight piano business. Talking machines affected the music box business. Radio is the newest stage of development of the musical instrument and as such it will be preferred to the old, and why should it not affect certain lines of the music industry?

In the main, therefore, I agree with Mr. Friedstedt's allegations.

Supposing when the Regina Music Box was threatened by that new toy, the talking machine, the manufacturers of the music box had said to the music trade, "Beware of the talking machine." I ask you, "What would the music merchant have said to that?" Mr. Friedstedt's article is like the cry of the king, who, sitting at the seashore, was angered at the waves rolling in and commanded them to stop.

This question to Mr. Friedstedt: "If a new type of talking machine suddenly made its appearance on the market and largely interfered with the old type, could the manufacturer of the latter be heard to complain that the new device was interfering with the music industry?" The music merchant would readily surmise the results of the clash between the new and the old, but it would not interest him that the replacement of the old by the new affected certain manufacturers. He would naturally want to handle the new because the opportunity for business and profits would lie with it.

If Mr. Friedstedt is right in his statement "that radio is hurting the roll business," I would ask him to take consolation in the thought that except for broadcasting stations the roll business would be worse. Broadcasting is giving strong impetus to record, roll and sheet music sales, by virtue of its inherent advertising force. Who, with knowledge of the facts will dispute this?

A typical example of the effect of broadcasting was furnished by the testimony volunteered at the first meeting of the National Association of Broadcasters when Mr. Wendell Hall, a song writer, made the declaration that "Mellow Moon," which he had written, made no appreciable headway in the hands of a publisher who resorted to the usual avenues open to publishers for exploiting a new musical creation. There was practically no sale. Then Mr. Hall began singing "Mellow Moon" at KYW and WDAP Broadcasting Stations. He stated that in the month of April the sale of "Mellow Moon" jumped to 100,000.

Mr. Friedstedt's article questions "how long radio broadcasting would continue if we, the broadcasters, were obliged to pay from seven and a half to twelve and a half cents for everyone who listened in, as roll manufacturers do in the instance of every roll that is manufactured whether it is sold or not." Not a fair comparison, Mr. Friestedt, because the record and roll manufacturer takes only the music that has been popularized, sometimes at great expense through song plugging, etc., etc., whereas the broadcaster offers to the public for their judgment the new publications before they have become popular, and ofttimes popularizing them at no expense to the publisher.

But, after all, in the main I agree with Mr. Friestedt's allegations, the few points of his article that I do not agree with are of lesser importance. His article as a whole is without doubt one of the most cogent arguments I have ever read, in support of the proposition that it behooves the music dealer to sell radio before the industry is absorbed by the electrical dealer and becomes a real enemy of the music industry.

WLW Publishes New Music Free for Radio

FACED with the opposition of a certain group of music publishers and composers, a number of the broadcasting stations have been considering for some time the possibility of building up a corps of music writers who would be more or less directly in the employ of the broadcasters, and whose compositions therefore would be available for free transmission by radio. What is perhaps the first step in this direction has been taken by station WLW, operated by the Crosley Manufacturing Company, Cincinnati, Ohio. This company also owns the Crosley Publishing Co., which has recently published "Somebody Else," a song composed by Aichele and Schmidt, two Cincinnati composers. This song was popularized in Cincinnati and vicinity through WLW. It was one of a number of compositions by the same men which were tried out by radio and was the one most cordially received by the radio audience.

Copies of this song have been distributed to all broadcasting stations not affiliated with the musical association that has been demanding fees of certain broadcasters. The experiment is being watched with great interest by everyone as its outcome may have considerable bearing upon the source or sources of music that will be available for use by radio transmitters.

WHAT'S THE MATTER WITH RADIO?

I CAN GET SCRATCH RECORDS TO PUT IT OUT IN A SPECIAL RELEASE FOR $1000,00- AND -
THAT'S THE STUFF! DON'T SPARE NO EXPENSE ON THIS SONG.- WE GOTTA MAKE IT GO!
NEW SONG
-AND THEN THERE'S THE BROADCASTING STATIONS--
HEY!!
NEW SONG

(Scene: The president's office in any one of a number of popular music publishing houses along Tinpan Alley, New York)

MUSIC MAGNATE (putting down telephone): Well, I just closed with Blinks for that new song of his. Got it for $10,000 and ninety per cent. of the gross. Now we gotta make it, and make it go BIG.

HIS MANAGER: Fine! I can get Scratchi Records to put it out in a special release for $1,000.

MAGNATE: That's the stuff! Don't spare no expense on this one, we gotta make it go BIG.

MANAGER: Then there's Hootchie and Kootchie, I can quietly slip 'em $100 a week apiece to use it in their new act in the big-time vaudeville.

MAGNATE: Swell!

MANAGER: I ain't seen Joe Jazzbo lately, but I guess maybe $100 a week ought to fix him up to use it every night on the Bustanybody Roof.

MAGNATE: Make it $150; we gotta make this one knock 'em cold. Don't spare no expense, that's the way to sell a million copies.

MANAGER: Calcium and Claque are putting on a new girlie show, and I hear they're looking for an angel with some dough. Maybe if we—

MAGNATE: Now you're talking, boy! Slip 'em $10,000 if they'll feature the song and play it with reprises in all three acts; nothin' like that to put a song over.

MANAGER: Then there's the broadcasting stations. I'll send 'em complimentary copies to popularize it. Everybody in the whole country'll hear it.

MAGNATE: Hey! How do you get that way? Radio! Don't you know that song's copyrighted? Think I'm going to let 'em use it for nothing? Nossir; notify all the broadcasting stations that if they want to use a WOW number like this one, y'understand, they gotta pay us right away a stiff license fee, get me? This is a business; not a charity institootshun!

Radio Audience Decides Programs

Balloting by Readers of THE WIRELESS AGE on "The Ideal Program" Shows Striking Comparison with "The Average Program" as Reported by the Broadcasters—A Little Less Classical Music, a Little More Jazz—Sports Very Popular

THE public is getting just about what it wants in the way of broadcast programs. That statement may be looked upon as a gratifying one, or perhaps it may occasion some surprise; but it is not an idle statement, nor one based upon impressions. Facts back it up. The listener has spoken.

"Giving The Public What it Wants," was the title of an article printed in the May issue of THE WIRELESS AGE and outlining the average broadcasting program. The material for that article was obtained by analyzing programs of the broadcasting stations. The averages showed a number of interesting things regarding the relative time given to contrasted features.

On the assumption that the broadcaster was in intimate touch with the public through the mails and through the telephone and telegraph, it was assumed that presumably the program managers were giving the public what it wants.

But it seemed better to get an actual vote on these preferences, and, as readers will remember, there was included with the analysis of the "Average Program" a blank on which subscribers were requested to indicate exactly what they wanted in the way of radio programs.

Clara Deeks, lyric soprano, is liked by the radio audience because of the perfection of her talent

As a result of the tabulation of these ballots returned by readers of THE WIRELESS AGE, it now can be stated definitely that the radio program impressarios are meeting the public desires with really astounding accuracy. The tabulation of the preferences of readers, when compared with the tabulation of the average radio program, shows only two decided differences.

First, the radio audience wants just a little less classical and operatic music, and it wants just a little more jazz. Specifically, it wants 4 per cent. less classical stuff and exactly 4 per cent. more dance music.

The second difference is, that while the broadcasters revealed that 23 per cent of their time is devoted to market reports and weather, the readers of THE WIRELESS AGE feel that 9 per cent. is enough.

This dual tabulation of programs from the point of view of broadcasters and of radio listeners, presents a truly extraordinary agreement of opinion. Obviously, classical music and jazz are the two most important features in any program, and for the stations to arrive within 4 per cent. of perfection in meeting the desire of the public certainly cannot be considered less than remarkable.

The interest shown by readers of THE WIRELESS AGE in this matter of programs was notable for its steady character. The blanks printed in the May issue began to arrive in the mails on the second day of May, and kept on coming steadily well through the month of June, from every part of the country. Usually in questionnaires of this character 90 per cent. of the replies arrive in the first ten days and the rest are scattered over the following week. In this case the returns were well distributed over two months, showing the continued interest of the readers in the subject.

This is how the complete returns may be summarized:

The broadcasters are giving 34 per cent of their time to classical music. The readers of THE WIRELESS AGE think 30 per cent. is enough.

The broadcasters spend 25 per cent. of their time in transmitting jazz; the readers want 29 per cent.

The broadcasters report 23 per cent. of their transmitting time given over to market reports and weather; 9 per cent. is enough.

Speeches and lectures take up 18 per cent of the time; 20 per cent is desired.

A Pertine

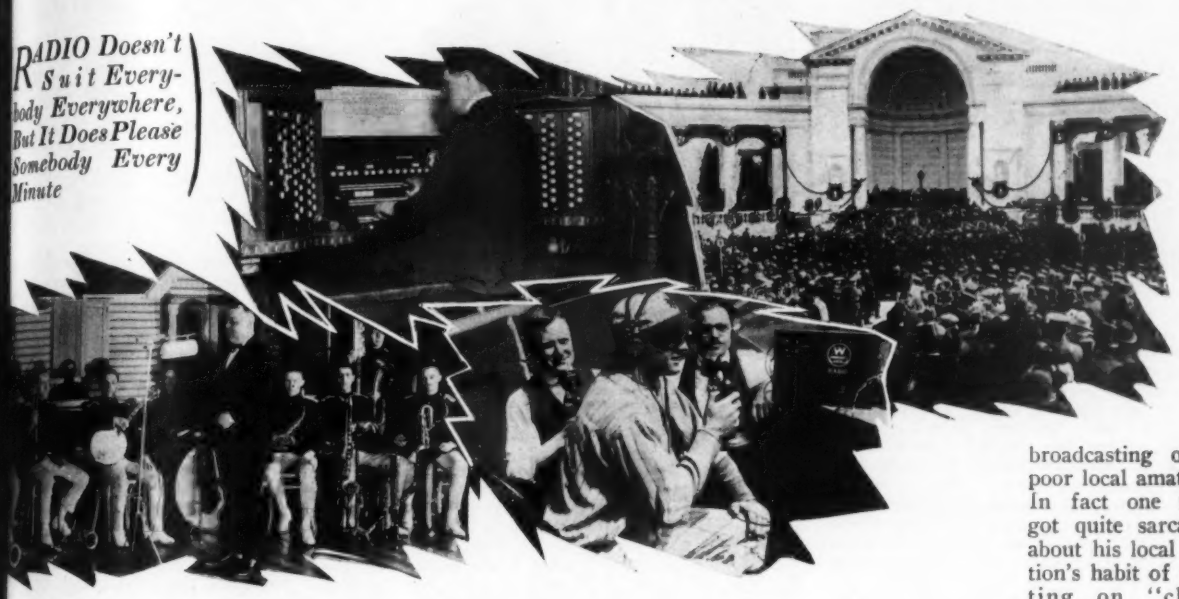
THE "AVERAGE PROGRAM"

As reported by the broadcasters to The Wireless Age

Classical and Operatic Music	3.0 Hours	34%
Jazz	2.2 Hours	25%
Market Reports and Weather	2.0 Hours	23%
Speeches and Lectures	1.6 Hours	18%
	8.8 Hours	100%

Are Almost 100 Per Cent Perfect

RADIO Doesn't Suit Everybody Everywhere, But It Does Please Somebody Every Minute



And a new classification, "News and Sports" must be created and 12 per cent. of transmitting time devoted to that.

Many of the blanks contained interesting remarks. The request for operatic selections accompanied by explanations and translations of the foreign words was made a number of times. The dramas broadcast by WGY were especially singled out for favorable comment by listeners in all the eastern states and through a large section of the middle west.

Few criticised classical music as such, and most of those confined themselves to complaining about "female song birds" and "screeching sopranos" and similar expressions that showed that they objected to the lack of artistic ability of the performer rather than to the character of the music.

The chief value of radio broadcasting as seen by readers of THE WIRELESS AGE is as a medium of entertainment. Its next most important function is the dissemination of information; and the third is its value as an educational medium.

The dispute as to how music should be broadcast, whether by personal performers or through mechanical instruments, such as phonographs and player pianos, is settled most decisively in this questionnaire. One lone fan says he prefers the phonograph and player pianor to personal performances in the studio. All the others are strong for hearing the performers themselves. A few of these, however, add the remark —and a natural one it is—that they would rather hear a phonograph record of a good artist than the personal broadcasting of a poor local amateur. In fact one man got quite sarcastic about his local station's habit of putting on "child wonders."

The question as to where the radio audience lives is given an interesting answer. An equal number of blanks came from people residing in industrial communities, from those who said they live in agricultural districts and from those who live in big cities. Radio broadcasting's complete coverage of rural and urban America is evident.

Surprisingly enough very few "DX fans" complained about their local stations. Only four readers said they thought that their nearby transmitters ought to transmit less in order that the more distant stations might be heard. The general conclusion of the readers is that stations should transmit more rather than less, 61 per cent. of the replies requesting more time and only 39 per cent. asking that less time be devoted to broadcasting. Among the latter who said they would be content

arallel

THE "IDEAL PROGRAM"
Revealing the preferences of the radio audience

Classical and Operatic Music	2.6 Hours	30%
Jazz	2.5 Hours	29%
Market Reports and Weather	0.8 Hours	9%
Speeches and Lectures	1.7 Hours	20%
News and Sports	1.2 Hours	12%
	8.8 Hours	100%

Sasha Culbertson, violinist, has given the world much enjoyment by radio as well as through his Vocalion records. And Erno Dohnanyi, pianist (right), makes listeners-in like his classical numbers

with less material on the air was one farmer who reported that two hours and thirty minutes a week would be plenty for him and then added, "that is more than I can listen anyhow."

The following quotations are taken from the remarks on various blanks:

I prefer music produced personally if the artists participating are first-class. There are too many stations with poor modulation. Abolish card acknowledgment. The other fellow does not care whether John Smith sent a card or not.—E. H. KOEBLE.

Concerts, plays, dinners, sporting events, etc., transmitted by remote control, are in my humble opinion the best method of keeping radio before the eyes of the public. More compliments seem to "fly" after some remote control transmission than at other times. I don't mean by this, studio concerts, etc., should be discontinued, as they in themselves are often very fine and a great credit to the stations.

Church services are very beneficial indeed to everyone and one of the best pieces of work the radio has done is to bring the church into the homes of folks who for some reason or other are unable to attend it.—R. S. COFFIN.

If you take into consideration the middle southern states, like Virginia, North Carolina, South Carolina and Georgia, which are practically without any important station on which we can depend, except Georgia, only when the weather is favorable, otherwise we are depending on KDKA, WGY, WEAF, WWJ and other stations in north.

Those stations do not take into consideration the southern states and conditions and their programs are to suit the local conditions only. They do not realize that their evening audience consists of rural districts, and especially in the south.

THE DEBATE—Ransom H. Gillette, left, counsel for the Association Against the Prohibition Amendment, argues it out over the air with Wayne B. Wheeler, of the Anti-Saloon League

We are too busy to listen in day time and we do not care what kind of program they have, and we can't get them in daytime anyway. We start to listen in from 7 p. m. to about 11 p.m. eastern standard time. We want more information in form of newspaper headlines if possible, we want weather reports, states by states as broadcasted by NAA 10:05 p.m., but which is not powerful enough to serve the purpose; and we want more lively music. The ideal program should consist of dance music and old time popular pieces which really never are getting old.

During intermissions, news of importance should be broadcasted in very short terms. Lectures on new discoveries of importance are very welcome but should consume no more than 15 minutes.

Boxing bouts are very interesting. Arlington time signals and weather reports are just of same importance as the whole program and should be broadcasted by every powerful station.

On Sunday if I want the church service I rather go to church personally, but at home I and my family want some amusement.

I have invested about $500 in my receiving set not only amuse myself, but my wife and two little children.

The classic music and preaching is good for my children when we want them put to sleep, but to amuse them we want to have more lively music.

I want also mention again the importance of weather reports; how important they are for us. We are living in wide open country with the skies above us.

The urban people are different; they are spending most of their time under ground in the subway or some other contraption, never seeing the skies; and do not care if the sun is shining or is raining. Taking into consideration our farmer, he is here practically without any early weather report except he is getting same from newspapers which he is receiving 12 to 24 hours late. Same also applies to news. And most important of all we want *more powerful signals during summer time.* The more powerful station, that much better and sometimes preferred regarding the program selection. —T. DABER.

If broadcasters want to do something they can broadcast enough church services so that every crystal set in the U. S. A. can listen in. If you don't believe it ask your readers. They will tell you there is a big field for Sunday Services.—G. T. FOSTER.

I do not agree with KFED of Billings Polytechnic Institute, Billings, Montana. He

THE "IDEAL PROGRAM"

I would like to hear daily by radio:

4 Hours 0 Minutes Classical and Operatic Music
0 Hours 0 Minutes Jazz and Popular Music
0 Hours 0 Minutes Market and Weather Reports
3 Hours 48 Minutes Speeches and Lectures
1 Hours — Minutes News, Including Sports
8 Hours 48 Minutes Total Time Daily

RECEIVED WIRELESS PRESS MAY 4 1923

Here is my idea of the value of broadcasting: Educational 2, Entertainment 1, Information 3 (Use the numerals 1, 2 and 3 to show relative importance. If you think Educational value is first put a 1 in that square, etc.)

I would like my nearest stations to Transmit More ☐ X Less ☐ (mark which) High grade music / Jazz

I prefer music produced (mark how) Personally X if high grade, By Phonograph and player piano X if interior talent.

REMARKS: Reduce the number of inferior programs. Stations broadcasting inferior programs should not "hold the air" for more than 1 hr. during evening. Many popular stage favorites should be seen over the footlights rather than heard over the radio. Band & orchestral music very pleasing over radio. The saxophone should be "Verbotten".

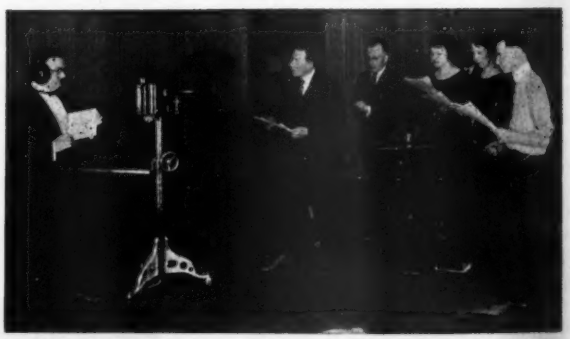
Have we your permission to quote your remarks in THE WIRELESS AGE? X

The Community I live in is (check which): Industrial ☐ Agricultural ☐ Big City X

Name G. B. Schneeberger Age 31
Address 13948 Parkway Dr.
Lakewood O.
Cleveland District

Mail to THE WIRELESS AGE, Program Editor
326 Broadway, New York City

(If you do not wish to mutilate your copy by tearing this out, write your program on a plain sheet of paper, or send us a postcard and we will forward a duplicate blank for you to fill out.)



THE PLAY—WGY has earned a great reputation with its weekly dramas, presented in its own studio, as shown above

THE BRASS BAND—WJZ pleases thousands on its Navy Nights, when a Navy band plays the best military music

Left—A typical ballot from a reader

states that "the churches will be far better off if they will confine their services within the walls of the church itself, rather than send them out into the air mixed with the racket of the jazz band." I do not profess to know the laws of the states, but it seems to me that jazz has no place in the air on Sunday evening. Why not keep the jazz within its walls rather than send it out into the air mixed with church and religious services. They only come one day in seven, and why not let them have a full day of it if they want to. Up here there is no dancing allowed on Sunday. Why should jazz music be allowed to fill the air. I'm not one of those "Blue Sunday" enthusiasts, but I certainly believe there is a limit to all things. Jazz has six days in the week to fill the air, and is not contented, but it must have the only remaining one. As far as that goes, our own stations are as bad in that respect, but every station would do well to follow the example of one of our broadcasting stations here, who refuses to play dance music on Sunday evening. He was requested several times to play a certain record, and refused to do so, and also told the radio audience where they were getting off in that respect.

With reference to the item, "I prefer music produced personally or by phonograph and player piano," I would like to say that I always prefer music produced personally unless some third or fourth grade artist starts to perform, then I would prefer the canned music by far. We have had some of this kind up here, and it simply is awful at times. Once in a while they put on a really good entertainment, but the chances are that the next three or four are punk. If it wasn't for being so close to the station, I'd tune him out and begin looking for KPO or KGG, or WLAG. That would make a good cartoon for Briggs to draw under the heading, "how to spoil a perfectly good evening."

But then it is hard to please everybody, as KGB says in the article, and "consequently it is necessary to so arrange the program so that there is a preponderance of neither and a sprinkling of both." Something new and novel is what the radio public is after, and "variety is the spice of life."—ERIC ANDERSON, 4AC, Calgary, Canada.

Would like to hear time signals regularly on, say 485 M. Would like to hear a little slow code practice every night, also weather reports for Montana.—JAMES E. WILLIS.

I would like to see two or three large stations in each state do the broadcasting. Quality instead of quantity.—B. B. LEE.

I have been a radio listener for over a year and in that time I have found that the most interesting programs are often classed under the "Out of the Studio" class of entertainment. The applause that follows the entertainer makes it more realistic and then, too, the entertainers are usually of a higher type than those who are engaged for a studio program. The programs given by the WGY players however are an exception to this rule. I think WGY should be highly complimented on their success along this line.—HENRY J. LATSHAW.

Radio does not improve the quality of the speech or music transmitted. It is never better over the phones or loud speaker than in the studio. Hence radio has no real value for transmitting programs which anyone can hear practically at will. There is ordinarily no reason for broadcasting phonograph records when most persons who have radio equipment either have phonographs or can hear them almost any time. A really fine record or, more especially, the recording of a master for the Ampico or Duo-Art is, of course, an exception.

The great function of radio then is to enable people to hear that which they could not otherwise hear at all, or to enable them to hear it at a time when they could not otherwise hear it.

This rule applies with equal force to programs that are educational or have merely amusement value. The principle is the same whether it be an address by Senator Borah or the Willard-Johnson fight; Isham Jones' orchestra or Madame Homer. The reason why I have given less time value to popular music than to classical music or lectures is because one can, generally speaking, hear popular music at first hand without much difficulty. I have not allotted much time to market reports or news, because their only value is where the time element is involved, that is where they beat the newspapers. They ought to be long enough to give the farmer and the business man necessary market information and give it when he needs it. The only other news broadcasted should be the really late news which is not in the papers —baseball returns, late cable dispatches, etc. There is no reason to tell the world about a Pennsylvania pig which was buried in a straw stack, as one station did recently.

Personally I lean towards speeches and lectures. I mean addresses such as the one recently given by Donald MacMillan or banquets where we heard Elihu Root and Henry Van Dyke. These are the things most of us could not otherwise hear.

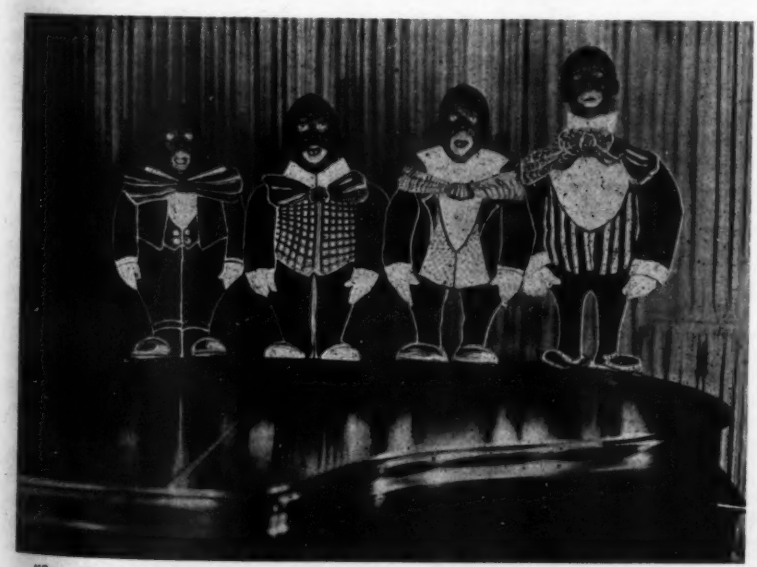
Two youngsters keep Mrs. Poland busy and keep her at home. But the other morning she brought the electric iron into the living room and for an hour ironed and listened to Lord Robert Cecil.

This I believe is an illustration of the real value of radio.

The novelty of indifferent reception of indifferent programs will soon wear off. We will not long be transported into ecstacies by hearing a phonograph record a hundred miles away that we could hear better in the next room.

The permanence of popularity of radio must depend upon the permanent value of the programs. Let us have programs embodying the best thought of the day, and good music of real educational or entertainment worth and made of numbers which a majority of the listeners could not otherwise hear.—ORVILLE S. POLAND.

Maybe you have seen these maids on the stage, as well as heard them by radio. They are the famous Bambalina chorus from "Wildflower," the play whose first act was broadcast to its immediate and large profit



"Sweet 'taters an' possum 'way down in Alabam, UMM, mmM!" And the mouths of the audience water, too, when they hear this Radio Four through WGY. Left to right, Carl Jester, Asa O. Coggeshall, Kolin Hager and J. F. Quinlan

NOW that thoughts have been photographed, and movies can be transmitted by radio, broadcasting can do the movies a great service by transmitting thought movies to show everybody up

Read What

Alice Mills

Told Sam Loomis

Alice Mills

DID you hear Alice Mills one night not long ago talking by radio to her many movie fan admirers? Were you disappointed that she just talked, instead of singing, too, as the programs promised? Well, so were a great many others. And after it was all over and Alice (let's call her that because the announcer took that liberty and so did most of those who wrote to her that very night) had gone home, she snapped her fingers and frowned and said to herself: "Now, there, I just knew I had forgotten something!"

The forgotten idea. That was what we discussed one afternoon soon after her voice had gone out on the air.

The discussion revolved about the newspaper stories descriptive of the taking of pictures of thoughts. Remember?—how some European highbrow had made some special kind of photographic plate, and all you had to do was wrap it up, sit with it in a dark room and concentrate, and then when the plate was developed it showed what you had been thinking of?

Well, that's the idea. While it doesn't seem to have much to do with radio, it really has, says Alice. She thinks—knows—that the movie world isn't as black—or red—as it is painted. Alice thinks all the movie people are just too nice, and that it's awfully horrid of the world to talk about them all just because one or two happened to be naughty.

The world doesn't understand.

And that is where radio comes in—to make the world understand. So far, radio and the movies have been co-operating nicely, for through your receiver you have been able to hear the voices of the stars you admire on the screen. The voice tells a great deal, and the radio audience seems to be able to judge these actors and actresses pretty accurately as they are heard by radio. If only to the voice could be added the picture! Well, radio movies are coming, scientists say.

But don't forget those thought pictures. Suppose motion pictures were made of people's thoughts, and then transmitted by radio while they spoke?

There's the big idea.

"Gracious," laughed Alice. "A lot of people would have to watch their step! Think what good it would do! No more misunderstandings. Everybody shown up in his or her true character."

Frankly, this was alarming. "Why, there wouldn't be any privacy left," we gulped. "The thoughts that shouldn't be thought can't be thought right out in public. 'Sterrible! Why, lots and lots of people wouldn't have any thoughts left at all if they thought that their thoughts had to be censored by their thoughts. And there wouldn't be any romance any more."

"Exactly; that's just it," smiled Alice. "You don't get the idea yet, the tremendous possibilities of it all. Just think how it would make the world over. Take a picture of George Goodboy and his thoughts when his mother-in-law arrives for a visit. At the same time, take a picture of the mother-in-law's thoughts as she sees her son-in-law."

"And this is the age of peace," we groaned.

ALICE gazed at us pityingly. "That's just it. You get these pictures, and you exchange them. Each sees what the other thinks."

"Awful," we moaned, chokingly.

"Awful, yes, of course, it always is, or so they say, for I'm not married (Alice blushed); but when those two see each other's thoughts and realize that one is just like the other, can't you see how they'll begin to understand? A bond of sympathy, you know.

"But now let's talk about radio and these thought movies. I think radio is just marvelous, and it's doing a great deal to make the people know the true characters of the motion picture celebrities, but the trouble is that the people who criticise never get their true characters pointed out. If we could only broadcast two sets of thought movies, one of the motion picture people and the other of those who condemn them.

"This is how it might go: First, thought-movies of Dr. Blankety Blank, the reform leader. These would show some gold-digger ladies, a case of hooch, a barrel of beer, several auto-

(Continued on page 46)

Dearest Alice:

I was listening over my girl friend's radio last Friday night. When I heard your name called out I was very delighted; I also heard Mae Murray speaking over the radio. So far you're the second lovely actress that I have heard over the radio. I think you have the loveliest, sweetest voice that any woman can want. Alice, if you only knew how crazy I am over movie folk you would laugh.

If I am not mistaken I think I saw you play in "What's Wrong With Women." You might not believe me if I told you that I go to the (movies) about four or five times a week. I buy movie weeklies and I cut out movie actors and movie actresses. I buy a book and paste them in.

Now, dear Alice, I have not your picture. But I hope that you will send me a nice large picture of yourself. But I not only want your picture but I want your friendship and "Especially" I want you to answer me. I will always write if you will always answer.

As soon as you got done talking I sat down and wrote this little letter to you, Alice dear. I hope you will be pleased to receive this letter.

If ever you should move or travel I want you to send me your address.

If you don't want me to address your letter you can send me your home address if you care to. I will write and tell you how much I appreciate your picture and your little letter.

I wish you would excuse my crossing out words as I am in a hurry to mail this. But the next letter will be written much better and with nicer handwriting.

I remain as ever, your dear friend,

Florence M.

P. S.—Please answer. I love you. I will love you more when I get acquainted real well.

"MY great desire is to help people. I found that astrology offered me the best medium for humanitarian work, and now radio comes along to give me the widest possible influence"

Said

Belle Bart

Astrologist, to Edwin Hall

Belle Bart and a horoscope chart, such as she draws to visualize the planetary positions

BUFFETED, bruised, bent, yes, broken under the bludgeon of cruel Fate. Seemingly punished for no conscious wrong-doing. Crushed to earth, or perhaps harried hither and thither, willy nilly, until the bewildered wits lose all sense of direction and halt in blind amaze in the midst of the march of events too deep for comprehension. Stricken with grievous and undeserved ills.

How many people are in such states of mind and being? Thousands, you say? Perhaps tens of thousands? Nay, their number is legion.

Belle Bart will tell you that. Belle Bart knows. And she knows now that the one best way to reach these people with the messages she has to give them is to use the radio telephone. Belle Bart, as many of the radio audience gratefully know, is the astrologist who has been giving weekly horoscope readings through Station WOR. She has been one of the most astoundingly popular features that broadcasting has yet produced—and at times one of the saddest, too.

Astrology. The science (she calls it higher mathematics) of interpreting the influence of the stars upon one's life. A venerable science whose origins are lost in the dim centuries before the glories of Chaldea and Babylonia shone upon the ancient world.

It has been proved by modern scientists that the moon influences the growth of plants and the lower forms of animal life; the ancients knew that not only the sun and moon but also the planets had each their individual kinds of influence on human lives. Astrology has come down intact to us today, and many there are who now thank radio for introducing them to it.

"Have just heard my horoscope read from Station WOR and am deeply grateful—grateful in that it has helped to clear my much confused mind," writes one woman, and she is but one of thousands, for actually thousands of letters have come to Miss Bart. Not that she has been able to answer them all; there is not sufficient time, and, to tell the truth, some of them do not seem worth the trouble. Those who merely write down their date of birth, for instance, without indicating that they have any particularly pressing problem besetting them, obviously must give way before those who write the many letters that show unmistakable evidence of distress.

For it is as a humanitarian that Belle Bart took up the study of astrology. She is a talented—and beautiful—young lady. Several careers were open to her, and are. Journalism, for instance. Commercial law, for another, in which she showed skill and which offered her greater financial returns than astrology does. But her study of astrology showed her that it was through that medium that she could do the most good.

And good she has done. "I could tell you," she said, "of scores of families that I have held together. I say I could tell you, but of course I really can't, because everything I learn is confidential. All those secrets are safe with me. My great desire is to help people, and I am so glad that astrology enables me to do so, and particularly that radio broadcasting gives me a wider influence and field than ever before."

THE fact that she is disinterestedly humanitarian is proved by her use of the radio, for she charges a fat fee for personal consultation in her studio. It would be so easy for her to sit at home and collect those fees, forgetting those who cannot or do not want to pay! But she offered to read horoscopes free by radio. "Write in your date of birth." she announced after a short explanation of what astrology is, "and next Monday evening I will tell you what the positions of the planets mean to you." Here is just one of the hundreds of letters that came:

Last week the Shut-In Society of Pennsylvania presented me with a radio, and God only knows what despondent and lonely hours it has abolished. I can hear station WOR to some extent but somehow your talks reach my very heart strings. At first I thought you were some angel presiding over the radio but later I found that you are some one who can understand and sympathize with broken hearts. You will succeed in healing many, I know.

My life has been very dark. I've known nothing but poverty and severe illness since the age of seven, and now in the very prime of my life, I'm a wretched home-bound cripple, shut from the outside world. The only means of getting out of doors is in a wheel chair, which the Shut-In Society has given me also. My mother has to propel me, and God knows how my heart breaks when I know that I ought to be helping her, instead I'm a burden to her, but she loves me, and bears it all very bravely. In going out, I witness a terrible humiliation, as all people stare at me. I wish you would say a word of this to the radio audience. Tell them, that if they should see a cripple in the streets, above all, don't stare at him, avoid a broken heart and miserable hour that will eventually follow.

I'm sure there can't be much more good in my life, Miss Bart, but the following questions would interest me very much, if

(*Continued on page* 43)

"RADIO is a tremendous thing for the artist. By making millions of Americans like music, the artist has his audiences increased, he sells more discs and concert tickets"

Giuseppe Danise

An Interview With

Giuseppe Danise

Famous Baritone, by R. M. Clarke

THIS story, strictly speaking, should be written in French to give it its true atmosphere. This is what took place:

Giuseppe Danise entered his salon where I was awaiting him by appointment.

"Good morning," he greeted me.

"Good morning," I returned.

A faint shadow of disappointment passed over his face. "One told me that you speak French," he explained, enunciating his English very slowly and carefully. "As I speak English not well (a shrug of apology) it is very bad for understanding. You speak French?" This in a hopeful tone.

"O, oui, un peu, monsieur."

"Ah, that is good, *si vous parlez français,* then we have a language between us, we can talk together, *cela sera facile,* easy, eh?"

"Alors, parlons français!"

And so we were off. Although an Italian, M. Danise speaks perfect, polished French.

"I was much interested to hear you by radio last Sunday from the Century Theater," I said. "You make Brunswick records, and, as I understand that that company is opposed to its artists singing for the radio, I wondered how you had accomplished it."

"I knew nothing about the radio being in the theater," Danise explained. "I sang for charity, for the wounded soldiers, to help send them to the country for the Summer, and if there was a radio apparatus in the theater, I did not know it. So you see that what I was not responsible for, I cannot be held to account for.

"And I was not displeased, myself, when later I learned that my voice had been heard by radio. Of course I can see how the graphophone companies might think that their business is hurt by broadcasting. Maybe that is so, maybe not. I do not know. I cannot judge. But for myself, I found it a deep gratification to think that I had perhaps helped to popularize the wonderful invention of my countryman, Marconi. You see how that may be. Radio is his, it is an Italian invention and that is one reason, just one, *nota bene,* why I think I shall always be glad to sing for it.

"You understand, I speak for myself alone, *n'est-ce pas?* Because it was that extraordinary man Senatore Marconi, who invented radio I, an Italian, shall be always glad to pay a little bit of humanity's debt to him by singing for it, for his invention, for all the Italians who may be listening, and for the Americans.

"Radio est quelque chose d'extraordinaire, c'est merveilleux, il me semble d'etre fabriqué spécialement pour les Américans et pour la musique."

EVIDENTLY he had been studying broadcasting carefully, though he had only been on the air once. He went on to explain why he considered radio to be so extraordinary and marvelous, and just why it seemed to him to have been made especially for Americans and for music.

"The Americans are not very musical, *pensez-vous?* The jazz, *la musique populaire,* that is not good music. *Oui,* here in New York, *c'est une grande ville, le centre de belles choses*—there are thousands of music lovers, but *autre part,* in the rest of your big country, ah, there are very few in comparison to your population, *les cent millions d'habitants.* Radio, by playing for them the best music, and occasionally presenting to them the voices of the great artists, is giving all these people who listen—how many listen? You do not know? No? *C'est dommage! Eh bien, radio donne une grande éducation musicale.* Nobody likes to be educated, eh? *Bien.* But (and Danise raised his eyebrows) *voyez,* they get educated without knowing it!

"That is a tremendous thing for everybody, and especially for the artistes. *Voyez,* by making a million more Americans like good music, I have my audiences increased, doubled, tripled, *Le nombre est sans fin!* Then, I will sell more of my discs, give more concerts, and sell more tickets. Even the composers and publishers of the works I sing should sell more of their songs! Ah, *oui, radio est une découverte extraordinaire pour les artistes, aussi bien que pour les auditeurs, pour tous.* (Danise gave an all-inclusive wave of his arm.)

"And the future—that is what interests me very much indeed. I do not see why the manufacturers of radio apparatus should not form a 'trust' among themselves, assess each member a certain sum on each piece of apparatus sold, and pay artists in money as well as in the great *réclame,* the great advertising they get by singing for the wireless. In Paris they already have an apparatus by which you can put *cinq sous* in a box and hear a radio concert; why cannot you do that too, here? *Vous avez les pièces,* nickels you call them. *Cela serait populaire,* and what enormous fees could be paid the performers, musicians and lecturers!

"AND they will be enormous, when the time comes that the broadcasting firms can collect money from their clients. Think, with the phonograph, it is different. It is a royalty, so much on each disc, that pays the artist, and once the disc is sold, it can be played over and over, as often as you wish. *C'est autre chose pour le radio,* where you sing once for perhaps millions, and then it is lost, your song, your voice, and it cannot be brought back. *C'est l'artiste lui-même pour une seule fois!*

"Of course all this is a vision of the future, of the time when it will be possible to pay artists because there will be a revenue from the radio audience. But in the present, things are not at all bad. I do not see why some singers have been so upset about wireless. It has made great strides, it has had a tremendous development. They

(*Continued on page* 45)

RADIO broadcasting serves to advance the cause of the piano art by emphasizing defects in tone production and giving its tremendous advantages most liberally to players who produce pure tones

Thinks

Margaret Nikoloric

An Interview with Paul S. Gautier

Margaret Nikoloric

MANY of the radio audience have noticed that often piano solos reproduce extraordinarily well, but that at times the same piano in the same studio will sound simply terrible. "Difference between good and bad playing," perhaps you will say. Not at all. Two artists of equal calibre have been known to make the same instrument, under identical conditions, sound entirely different.

Why?

Madame Margaret Nikoloric explains it as a matter of tone production. As she has been heard on the air a number of times, with astonishingly perfect results at the receiving end, she ought to know. In fact, so well has her playing been received that she has even had paying engagements offered her from appreciative radio listeners.

"I think it all depends on the kind of tone that a player produces," she says. "If the tone carries a lot of overtones and harmonics, then it can not sound clear and distinct, but will be harsh, or muffled, or 'muddy.' Perhaps radio transmission exaggerates defects, and if that is the case, the better the tone the infinitely better the reproduction."

It was obvious that what was in both our minds was the feeling that if radio emphasizes poor tonal quality in piano playing, the artist whose tone was, say, twice as good as another's, ordinarily would sound by radio, perhaps four times as well. The idea of radio establishing a highly favorable condition in favor of the producer of good piano tones was established between us without more words. Mme. Nikoloric is the kind that can convey a great deal without descending to the dullness of mere detail—though one feels all the time that an intimate knowledge of the detail is there.

"Just what is it that makes tone in a piano solo?" I asked her, in an effort to expand her ideas.

"Well, this certainly is a real interview," she laughed, wriggling about a bit in her comfy arm chair. Then, with a glance at the big concert grand piano at her side, she added: "It's funny that you should ask me that, for that is the one thing that I have been studying all these years. I must know more about that than anything else. I've studied under pianists of all kinds. It never has mattered to me whether they were well known or not; if only I thought that they could teach me something, I would go to them.

"It is really somewhat discouraging at times, this hunt after tone, for often the very people who seem to have a complete mastery over it either don't know how they got it, or else can't convey the secret if they know it.

"There was one man who said that tone was all a question of dropping weight, which is not a matter of muscular force. Now I know that that is at least partly true. He told me to relax completely, and then let my arm and hand just fall. I did it, just that, and he turned in horror and said 'you must never, never do that again!'

"It is all a very complicated thing, though it sounds quite simple to say that the keys must not be struck. Striking a key causes the string to jangle. That's when you hear the overtones that take away the purity of the tone. Then, of course the key or scale in which you are playing has something to do with it.

"TO my mind tone production is more important than the average person thinks, if he gives any thought at all to it. Anybody can learn to hit the right notes if he will stick at it long enough, but that isn't all there is to playing artistically. It seems to me that radio is doing a real service to everybody by revealing so clearly what kind of a tone a pianist produces."

Mme. Nikoloric's interest in radio is intellectual as well as active. She is watching broadcasting eagerly. "I wish I knew how radio is going to go," she exclaimed. "Some time ago I was in Porto Rico on a visit, and I met a family who live there in the interior of the island, shut off from society, from schools, from everything. They have several children, and do you know how they have been educating them? They have a Victrola, and a large number of records, records that I had never known existed at all, educational records for instance. The children have been getting their education by phonograph, not only musically, but in other ways. Of course they have the language course, for instance, and they know all the operas much better than I do. That phonograph is going just all the time, and it has been the only thing that has kept that family together and happy down there in the jungle.

"NOW, of course, the radio is supplementing it wonderfully, with certain things that only it can give. They think it is most wonderful, the very best thing there possibly could be for people situated as they are.

"I suppose that radio will continue to grow in an educational way. I certainly hope so, for it is a tremendous force. Probably it is only in its infancy. There is one thing that certainly ought to be done, and that is to improve the musical taste of the people. I think that a course of lectures on composers, not so much their history, as that is pretty sure to be rather dry, but such things as the relation existing between their own lives and the instruments that were available to them for their compositions. A course like that ought to be very interesting and stimulating.

"You know that the old masters of piano literature didn't have the modern piano, and the instrument they wrote for limited them much more than the pianos of today limit the modern composer. I think you have to know

(*Continued on page* 41)

The St. Paul Radio Station

Radio's Control of Sealing*

How U. S. Navy Station in the Middle of the Bering Sea Protects the American Fur Seal Herd, Upon Which We Depend for Our Sealskin Garments

By Commander Stanford C. Hooper, U. S. N.

Head of the Radio Division, Bureau of Engineering, Navy Department

THERE are only two small islands in the Bering Sea that are suitable breeding places for the American fur seal, and on these islands radio is an essential part of the equipment of the guardians of the seals. The dumb, uncomprehending beasts ignore the tall towers supporting the spreading antenna, which is their best friend, a vital link in the system that protects them from extermination.

It was on June 8, 1911, that construction started on this interesting station, the American gunboat *Buffalo* having anchored in the evening of that day off the island of St. Paul of the Alaskan Pribilof group, opposite the small Eskimo village.

This vessel of war had arrived in this far northern region, up near the Arctic Circle, not on a mission of conquest, but on a mission of mercy, and one of very great importance to the welfare and comfort of the women of America and of the world. It had been ordered to establish and place in operation on this distant and desolate island a radio transmitting and receiving station, to provide the only possible means of rapid communication between the island and the outside world.

The establishment of this radio station was not intended to be altogether in the interest of the population of the island; it was intended, in fact, to be used primarily to assist the Government in its efforts to foster the growth of and to protect the seals of the American fur seal herd, the largest in the world, being more than ten times greater than all others combined. Without such protection the seals might be exterminated.

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The American herd resorts annually to the Pribilof Islands of St. Paul and the nearby island of St. George for breeding purposes, and is present on the islands for upwards of six months in the year, during which time the young are born on land.

From an extensive study of the habits of these seals the conclusion has been reached that they remain at sea during the other six months of the year, as no evidence has every been found to indicate that the seals of the American herd ever come ashore at any place other than on the Pribilof Islands. It has been assumed, therefore, that this is the only suitable breeding place for the seals; hence the action of the Government in setting aside these islands as a special preserve and sanctuary for the American herd.

PROTECTED BY RADIO

How many women who wear sealskin realize that radio has played a large part in making possible the ownership of their fur coats and cloaks? Yet that is so. Since 1911 a radio station in the Bering Sea, in the breeding place of the great American fur seal herd, has enabled the authorities to exercise year-round control of sealing. Without that control, extermination of the seals, which threatened to become complete only a few years ago, would have taken place, and these animals would have met the fate of the buffalo, which today is found only in zoos and in small herds in protected parks. Today, the seal herds are subject to scientific control, and only the surplus males are killed for their fur. Radio has perfected the control of the situation that in 1911 was so serious as to be a matter of international concern.

When Alaska was purchased from Russia in the year 1867, the seal herd is estimated to have contained approximately three million animals. During the years immediately following transfer, the herd was greatly reduced by pelagic sealing (hunting at sea) and unrestricted land killing.

In 1869 the Pribilof Islands were created by the Government a special reserve and breeding grounds for the seals, and by the North Pacific Sealing Convention of July 7, 1911, the United States, Great Britain, Japan and Russia agreed upon means for the protection of the seal herds of the Pacific. By this agreement the United States obligated itself to protect and promote the growth of the Pribilof herd, and to give annually to Great Britain and to Japan a certain proportion of the skins taken.

It was in anticipation of the execution of the terms of the Convention that the Navy was charged with the responsibility of establishing and subsequently operating in service a radio station at St. Paul, hence the fitting out of the *Buffalo* to undertake this work.

Very stringent regulations are now enforced by the Government for the protection of the seals and the maintenance of these islands as their special sanctuary.

During the six months of the year when the seals are ashore on the islands of St. Paul and St. George, every precaution is taken to avoid as much as possible any disturbance to the seal rookeries through activities on the part of man; vessels are prohibited from approaching the islands, and landings are allowed only by special permission of the Secretary of Commerce, the responsibility for the welfare and safety

of the seals being entrusted to the Bureau of Fisheries of the Department of Commerce.

On the islands, reservations are imposed regarding the visiting of the seal rookeries and hauling grounds, as non-breeding seals are easily frightened into the water, and groups of breeding seals are thrown into confusion by the presence of even one person, with consequent disastrous results to the newly-born young.

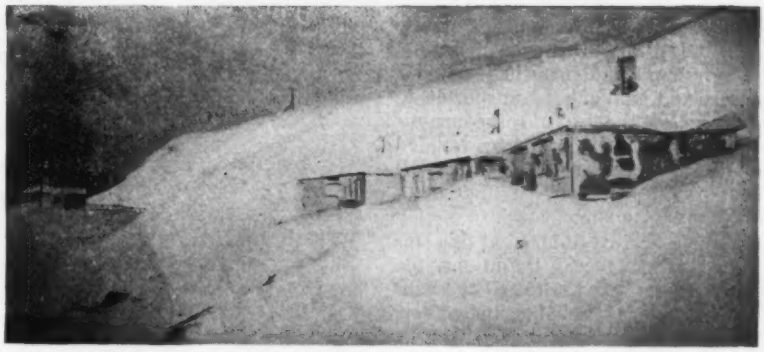
A careful census of the seals is taken each year by the officials of the Bureau of Fisheries when the seals are on the Pribilof Islands to determine the normal growth of the herd and to keep a check on unauthorized killings by sealers which may take place when the seals are at sea.

In the last census it was found that the herd is increasing at the rate of from ten to twelve per cent. annually, and although approximately. 25,000 animals are killed annually for their pelts, the herd in 1922 numbered considerably in excess of 600,000 animals.

The killing of the seals by the agents of the Bureau of Fisheries is done during the summer months when the herd is ashore on the Pribilofs, this, under the law, being confined to the surplus males.

Net revenue to the Government to the extent of something more than one million dollars in round figures is now produced from the disposal of these pelts each year.

Radio has played a big part in achieving this highly pleasing result, affording constant communication for reports of the seal herd and the presence of strangers. The Bering Sea is sufficiently free from ice to permit navigation only about four months of the year, and during that time the Bering sea patrol vessels keep watch and ward over the seals by eye and radio, working with each other and with St. Paul. The island of St. George has a low-power set, sufficient to enable it to communicate with the main island.



Almost buried in snow, in the lee of a drift higher than a house. Radio operators in the far north must go through winters such as this. Sometimes the snow even nears the antenna, as here, at Scotch Cap Lighthouse, Unimak Pass, Alaska. The wires seen just above the big drift belong to a Navy radio station

Here is the story of the installation as told by the commanding officer, Lieut. (now Captain) E. H. Dodd, U. S. N., in his report, which reads in part as follows:

The *Buffalo* anchored off East Landing, St. Paul, Pribilof Islands, Alaska, at 6:00 p. m. June 8, 1911. Dr. Morgan, the surgeon on duty on St. Paul Island, came on board the ship and reported the deaths of Dr. Chichester, Government seal agent, and Dr. Hahn, scientist, by drowning, one week previously. Dr. Morgan was the only white man on the island. The widows of the two drowned men were also on the island. The last communication between the Pribilof Islands and the outside world was by means of a Revenue Cutter the preceding October.

Mr. Hanscom and Chief Electricians Sutton and Wahlace went ashore on the night of the *Buffalo's* arrival and rigged up a portable radio set for communicating with the ship from shore.

On the following day an investigation of the island was made for a site for the wireless station. There was found to be no apparent advantage of one location over another. The site selected had the advantage of being near to the village the buildings would be clear of the deep snow drifts in winter, and the location appeared excellent for electrical ground connections for the radio set.

On June 9th four cutter-loads of bedding, mess-gear and provisions were landed at Lukanin and hauled by the native team to the village.

All landings then became too rough and continued so until June 11th.

The *Buffalo* shifted anchorage well off and abreast of Cove Landing, and on June 11th, from 3:00 a. m. to 11:15 p. m., material was landed and stored at Cove Landing. All the working party, the ship's force, all the male natives, all the ship's boats, and two native skin boats were used in this work.

The landing was too rough on the following day until 3:00 p. m. and material was moved from Cove Landing to the station site. Stores were landed from 3:00 p. m. to midnight on this day and on the following day (June 13th) until 6:00 p. m., when all of the material had been transported on shore.

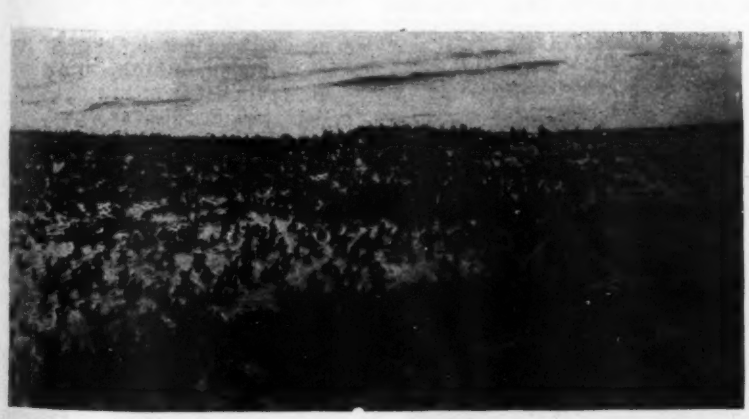
The work of building the station was commenced on June 14th. The work was finished and the station placed in commission July 1st, and the *Buffalo* sailed for Unalaska July 4th, 1911.

The natives of the island were of considerable assistance to the wireless party in handling material, although they are not very strong physically. Most of the natives are afflicted with consumption.

The erection of the station was handicapped by inclement weather about half the time, and on a number of occasions it was impossible to do any outside work, notwithstanding the season of the year, due to wind, rain, and cold.

No mention whatever is made of the difficulties of landing heavy pieces of apparatus and material through the surf and transporting it to the station site, nor to the remarkable performance of establishing the station and placing it in operation within an interval of time of only two weeks. Mention is made only of conditions which prevented the work having been completed more quickly. That is the U. S. Navy's traditional spirit.

Much more severe conditions have to be met year in and year out by the personnel at the station. When it is considered that two wood lattice masts each 225 feet in height had to be assembled and erected to support the antenna system, a substantial building had to be constructed to house the oil-engine-driven electric generators, oil tanks erected, and the radio transmitting and receiving apparatus had to be assembled and erected; living quarters



These seals are barking like impatient dogs as they waddle about. The shore is black with them, yet they are only a small part of the American herd that is 600,000 strong. The silent radio disturbs the ether to protect these valuable animals; only their barks and the boom of the waves breaks the silence of this desolate region

for the chief radioman and his family and also for the unmarried operators, had to be built and furnished, all with material and equipment transported to the island on the *Buffalo*, the magnitude of this undertaking in this isolated region under unfavorable weather and other conditions will be the more readily appreciated.

The permanent personnel at this station must meet trying conditions, the weather being very severe all the year through and unspeakable in winter. The little colony consisting of the Navy radio operators and the agents of the Bureau of Fisheries is virtually buried under snow and ice for approximately eight months of the year.

Regardless of weather conditions, however, the St. Paul station has been kept in constant operation throughout the twenty-four hours of each day ever since its establishment.

St. Paul now not only communicates with vessels of the Bering Sea Patrol during the season of navigation, but also with the Navy's eight other stations situated on shore along the coasts of the Gulf of Alaska. It can communicate with the United States through one or more of these stations or directly with stations situated along our Pacific seaboard from Seattle to San Francisco. It is capable of working with Naval and merchant vessels in all Alaskan waters and also with vessels far out in the North Pacific Ocean.

As a matter of fact, the St. Paul station is now regarded as an important unit in the Navy's widely extended chain of shore radio stations which are maintained to serve our Pacific and Asiatic Fleets and our merchant marine.

American merchant vessels in Japanese waters frequently relay messages destined to the United States, through the St. Paul station, even when they are unable to copy the signals of the St. Paul's 5 kw. spark or 30 kw. arc sets.

Perhaps since this bull seal was snapped with his mouth open he has parted with his fur to keep some society woman warm

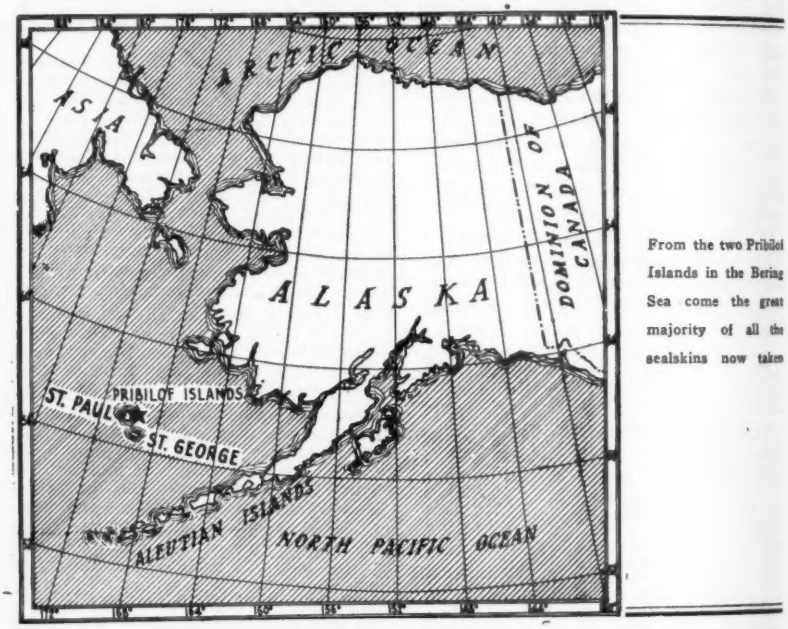
Signals from the radio station at Moscow, Russia, are readily copied by the operators at St. Paul as are also those from the high power stations in Europe, Asia and North America. Therefore, while this region remains geographically isolated, our little colony at St. Paul can keep in intimate contact with the world by radio.

The press news which is nightly broadcast from the Naval high power stations in the United States and elsewhere is readily copied. The radiophone broadcast programs from stations situated along the Pacific seaboard also come in at this station during the hours of darkness to furnish recreation, amusement and education.

Strange as it may seem, the location of the St. Paul station, and the primary purpose for which it was established, and its comparative isolated location, did not prevent it from playing an active and important part in connection with the World War.

Coincidentally with the dispatch of American troops to Siberia, the Navy increased the power of the St. Paul station by installing a 30 kw. arc transmitter in addition to the then existing 5 kw. spark set. An enlarged antenna system was installed as was also oil-engine-driven generators of sufficient capacity to supply power for the 30 kw. set. With the 30 kw. set, communications were exchanged with a corresponding station at Vladivostok, Siberia, thereby opening up a channel of communication directly between our Government in Washington and the American troops in Siberia.

Aside from the military value of this radio circuit, the saving in cable tolls to the Government within a few months more than offset the entire cost of establishing the St. Paul station and its subsequent operation and improvement.



From the two Pribilof Islands in the Bering Sea come the great majority of all the sealskins now taken

Midnight in Alaska—yes, indeed! One of the U. S. Navy radio operators took this picture one summer night in the land of the midnight sun

Radio Makes the Mayor Gay

New York City Had Its Silver Jubilee in Spite of Objections From Taxpayers and Others—Broadcasting Assisted in Raising Guarantee Fund from Depths of Citizen's Pockets and in Making Celebration a Financial Success

By Geo. W. Gether

THE Mayor wanted a Silver Jubilee. He had been looking at the calendar one day, and discovered, with the aid of a history, that now is the time for all good men to celebrate the Silver Anniversary of Greater New York.

That was an inspiration.

But—and here the difficulty developed—Jubilees cost money. At first, of course, His Honor thought nothing of the money. There was the treasury. Mayors have learned to rely on the treasury.

The good tidings spread. A line of jubilee celebrating experts wore a groove in the steps of City Hall. It was learned that no self-respecting Silver Jubilee could be jubilant on less than $200,000. A mere bagatelle, like that.

But there are at least two political parties in New York, to say nothing of a host of taxpayers who view with alarm the rising rates.

What? Spend $200,000 just to glorify the city? Nonsense (and harder words) said the taxpayers. What? Spend money on a joy-fest for the party-in-power? Never, exclaimed the opposition.

Now it happens to be a legal peculiarity that taxpayers can go before the court and complain, if they don't like the way their money is being spent, or the way it is planned to be spent. That is either convenient or not, depending on which side of the city you happen to live.

The Mayor found it most inconvenient. A certain group of wilful, testy taxpayers rose in their might and their legal rights to say that none of their money should be squandered on a Silver Jubilee thing.

And do you know, they actually succeeded in making it impossible for the city to spend any of its own money to fittingly celebrate its Silver Anniversary!

What to do?

His Honor and Commissioner of Plant and Structures Grover Whalen sat in solemn conclave.

"I got it!" exclaimed the Commish.

"Huh?" queried the Mayor.

"Radio!" proclaimed Whalen.

"What's that?"

"Greatest invention of the age. Reaches all the people everywhere. Anything you say by radio is used in your favor. Costs you nothing whatever to talk through it. Arouses respect, attention, interest, action. Ask 'em all to come to our Jubilee by radio. They'll come, you bet. Get all the business men and all the city employes to buy tickets. Buy 'em in advance. That's how we'll finance it. Right out of the pockets of the people who will benefit. Appoint a committee to raise funds. Talk by radio. Talk some more by radio. Do it every night."

"You do it," commanded Mayor Hylan.

AND Whalen did it. He talked by radio and he raised the funds, including a guarantee fund of $200,000. The expectant Jubilee jubilators were able to jubilate. Grand Central Palace was hired for a month. Expensive models of all sorts of things such as ash carts and street sprinklers and fire houses and similar rarities of a great city, were constructed and put on display. A gigantic electric fountain, the work of the General Electric Co., so it is reported, was constructed right in the Palace.

Every department of the city government was represented by an exhibit Pictures, models, diagrams, booklets, maps, reports, blueprints and oratory, all combined to show the city as was and as is. Festoons of lights made luminous tunnels of the streets leading to the Palace, wherein no faintest ray of moon could delve. It was a man-made, city-crammed exhibit of the master city of the universe, and then some. Wow!

Scores of famous movie stars and others, infected with the enthusiasm, sacrificed their leisure and comfort to make the affair a success. They consented to visit the exhibition, and even to be photographed in fetching poses for the newspapers, with such properties as monkeys, lion cubs, lambs and lounge lizards. All this, of course, to show the dear public the true atmosphere of Little Old New York.

And the speeches! Don't forget them. At least, you couldn't miss them, for whether you went to the Palace or not, you heard them. Quite so. Not less than one speech an evening was the rule at the Palace, and the more the merrier was the motto. Out they went by radio, direct from the scene of the festivities. The festivities, which depended largely on attendance, grew more and more festive. The box offices at the Palace resounded with the tinkle of the silver. For four weeks the orgy lasted.

Mayor Hylan at the radio-raised Jubilee

AND then, one torrid day in June, the Jubilee jubed its last jube. And the Committee, its guaranteed $200,000 in one hand, the assorted bills in the other, and the admission money in the other, raised a bright and happy face. It has spent $425,000. It had taken in, well, several bags of nickels, something between $425,000 and $435,000. Success! The guarantee fund need not be touched. The timid, testy taxpayers were properly rebuked for their temerity in suggesting that the city couldn't run a Jubilee in or out of the treasury.

Mayor Hylan knew it would be like that, from the very beginning. Just see, here is his letter of thanks to the Radio Corporation of America for permitting Commissioner Whalen to broadcast his invitation to each and every one of his listeners:

Last Friday evening I listened with great interest to the message which Commissioner

(*Continued on page* 43)

350 Headsets on Hospital's Staff

Hahnemann Hospital Glories in Record-Breaking Installation—Keeps Up Spirits of Patients, Say Doctors—Well Worth $2,000 Cost

By Wm. E. Johnson

Listening to a radio sermon in the Hahnemann Hospital, Philadelphia. The two jacks on the wall above the beds, into which the phones are plugged, are easily visible

HAD one of the speakers before a convention of medical directors of hospitals several years ago predicted that radio would be considered an important part of hospital life, he would have been laughed down.

Hospitals, as a rule, are bound to be dull and monotonous places—at least for the patients—in the long days of convalescence. For many of them it seems that ages pass between the visits of their friends, and, true, many of them never have visitors. They are like strangers in a big city. No friends and no place to go.

But no more for the patients in the Hahnemann Hospital, Philadelphia. In this institution, through the help of a women's society associated with the hospital and with the assistance of the officials themselves, a four-tube set has been installed which supplies amusement to more than 350 patients daily.

John M. Smith, superintendent of the hospital, and an enthusiastic radio fan says that the situation is such that if the set is out of commission for ten minutes during the day, the patients set up a howl that can almost be heard by the Philadelphia broadcasting station.

Georgie's smile writes the caption to this picture! He's in the children's ward

"Radio is now considered a part of the hospital," says he. "When a patient comes here he or she expects to listen in as soon as they are able. If they do not get their share of radio they let us know about it, just as they would tell us if the food or nursing did not suit them. It has created something entirely new for the hospital.

"We are enthusiastic about the possibilities of radio in hospitals. It means that every one of our patients can keep in touch with the outside world by means of press dispatches and the other features of the broadcasting stations, and that the weary monotony of lying in bed day after day is broken by the concert programs. It is showing its effect in keeping up the spirits of the patients.

"Naturally the very sick patients are not able to take advantage of the headphones at their bed, but as soon as they begin to convalesce and the excitement does not prove harmful they can plug in and listen.

"Several of the nurses who thought the idea ridiculous at the time because they felt the patients would not want it, realize now how wrong they were, because often they are forced to call me on the phone to find out if anything is wrong with the set because the patients complain that they don't hear anything."

The set is of the single-circuit type, using a forty-three plate variable condenser, a vario-coupler, one detector tube, two tubes of audio frequency amplification and one tube of radio frequency amplification. The set was built by the men in the hospital. It is not the first set they tried, a five-tube set, consisting of detector and four stages of radio frequency amplification, having been built first, but it proved an absolute failure.

This set operates three loud speaking units and 350 head sets. The loud speakers are used in the children's ward, the nurses' home and the chapel. The head sets are beside each bed in the wards and private rooms.

For this set to operate so many units seems almost incredible, yet it is really one of the simplest arrangements of wiring that could have been conceived. The loud speakers are operated from a Western Electric power amplifier. The output binding posts on the right hand side of the receiver are connected to a board about one foot long and six inches wide, bearing five switches, three for the loud speakers, while the other two control the circuits to the head sets at the bedsides.

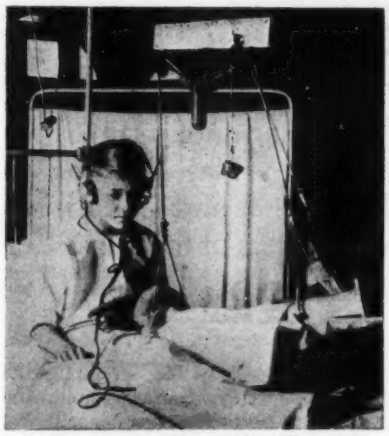
From this board two wires run over the entire building. They are carried along a moulding on the wall, and as they pass a room they are tapped by two wires which run to a telephone jack at the side of the bed of a patient. This jack is one of the latest types, being round, about one inch in diameter and one-half inch deep. The jack is set in a round piece of wood, about four inches in diameter, and one inch thick. Each headset has a plug, and all the patient has to do when he or she wants to listen is to plug in.

For operating the loud speakers, a telephone call is made to the operator who pushes in the switch for that particular horn.

The question of an operator arose when the set was being installed, and it was decided by the authorities that the telephone operator should learn to operate the set. The set is situated right beside the telephone switchboard, and all the operator has to do when she wants to tune in, is turn on her swivel chair. The set is operated continuously from 11 a. m. to 1 a. m., those being the hours when broadcasting is best available. Details, such as baths, doctor's visits and changing of dressings take up the morning hours to 11.

The patients are divided as to the programs they like best. Jazz, followed by semi-classical selections, seem to be preferred. They all agree, however, that radio is the greatest thing ever, regardless of the program, and for relieving monotony there's nothing like it.

The children's ward is strong for it. As the nurse of this ward said: "It really brings sunshine into their ward." As soon as the loud speaker is turned on out bob the little heads from their big fluffy pillows, and they do not miss one word or strain of music. There is one little lad in this ward who will not be satisfied with radio. His eyesight has failed. Physicians hope it is temporary. However, with his sad face buried in his arms he swings his body from side to side. Nothing comforts him. Radio does not compensate him for the darkness, though once in a while you can catch him listening a little.



Clarence Swenson, Minneapolis, Minn., must sit all day with one leg trussed up and a great weight pulling upon it. But he listens to the radio programs and so he's happier than you might think

Another little chap, covered with plaster of Paris from the tips of his toes almost to the lobes of his ears, and who has to be carried about, insists that he be brought right up alongside of the loud speaker as soon as it starts. He is an out-and-out enthusiast. Not realizing that he will be in the hospital for some time to come, he says: "I'm going to get a great big set as soon as I get home," and he displays a few pennies and nickels he has collected toward the set. "It's lots of fun. I like to hear those stories about the giants and the little men, and all the animals. I'll put an aerial about a mile long on my roof and I'll get everything then, won't I? Won't I, nursie?"

The set, loud speakers, head phones and installation cost the hospital about $2,000. Half of this amount was donated by a women's society and the authorities put up the other half. Mr. Smith says he thinks it is the best $2,000 the hospital has ever invested, and that it will give and is giving the biggest returns of any similar sum ever spent.

And on those dreary, wakeful nights, the invalids who before radio was installed thought that life was just too much to bear now push in their phone plugs, clap head sets on their ears, and think Mr. Smith is right.

This is Frank Houck, who lies tightly gripped in plaster, to straighten his spine. His smile is one of the Hahnemann's marvels. And radio is another, to him and to every other patient

Uncle Wip, the children's favorite character at Station WIP, Philadelphia, must have just said something about Billy Possum, to judge from the look of this little lady of color

Margaret Nikoloric

(*Continued from page* 35)

something of the piano for which Bach wrote in order to truly appreciate his music.

"After all, it really comes back to tone, doesn't it, for it was the tonal quality of the early instruments that influenced the composers of those days, and tone is the big thing by radio."

In her search for the secret of tone Mme. Nikoloric traveled over a large part of Europe and the United States, and studied for long and short periods under various teachers and artists, eminent, and some comparatively unknown.

Her serious studies began in Vienna, under the famous Leschetizky, though she hardly considers herself to be a "Leschetizky pupil" now, so far has she gone from the original method of the great old man.

It was while she was studying in Vienna that the talented Hoosier girl—she was born in Indianapolis, Ind.—became Madame Nikoloric. She met there a law student from Dalmatia, which at that time was a province under Austrian rule, much to the poorly suppressed indignation of its inhabitants. The student had come to Vienna, like herself, to seek the highest authority in his chosen profession.

And there he found not only the legal tutelage he desired, but also she who was to be his wife.

"It took me seven years to persuade him that I was the one," said Mme. Nikoloric gaily, and we laughed together at the idea.

"Gracious, may I put that in the interview?" I asked eagerly.

"Well, it's not just the way my husband puts it, but I guess you can say I said it," she conceded.

"Of course we had a lot of discussion before we were married. I was willing to go anywhere with him, to the Fiji Islands, if necessary, to say nothing of the Dalmatians, but my family didn't want me to leave America permanently. So eventually we came back here, and I think there is just no place like America! This is *my country*, and just the best place in the whole world to be. And my husband—he practices international law in New York City—thinks that he'd rather be here than anywhere else, too.

"Radio was just the one thing needed to make it quite perfect."

Broadcast Bible Study

Pastor in Dallas, Texas, Conducts Sunday Bible Class Through Station WFAA—Has Drawn Devoted Following in Many States and Led to Actual Enrolment of the Members of the Class

By Wm. M. Anderson, D.D.
Pastor, First Presbyterian Church, Dallas, Tex.

Wm. M. Anderson, D.D.

MUCH interest has been raised among the members and friends of the Bible Class which is conducted over the broadcasting station of the *Dallas News* and *Dallas Journal* by the stories of other classes and other stations, and a bit of pleasant rivalry has come up as to the claims of priority in organization. These things and the desire to pass on to others an account of the work of radio Bible teaching have moved me to tell the story of the WFAA Radio Bible Class.

I am pastor of the First Presbyterian Church of Dallas, one of the larger down-town churches, and like pastors of similar churches in many places I was interested in the possibilities of broadcasting the church services for some who might not be able to attend. It was while I was making an investigation of the possibilities of this service that the management of the *News* asked if I would undertake to conduct the half hour chapel service on the first Sunday afternoon of operation of the then contemplated station of the *News* and *Journal*. Quickly, although with some fear and trembling, I agreed.

It was then said that the next day, Friday, June 23, 1922, would be the first test day; that Saturday following would be also used in testing and that Sunday would wind up the testing ready for official opening June 26, 1922.

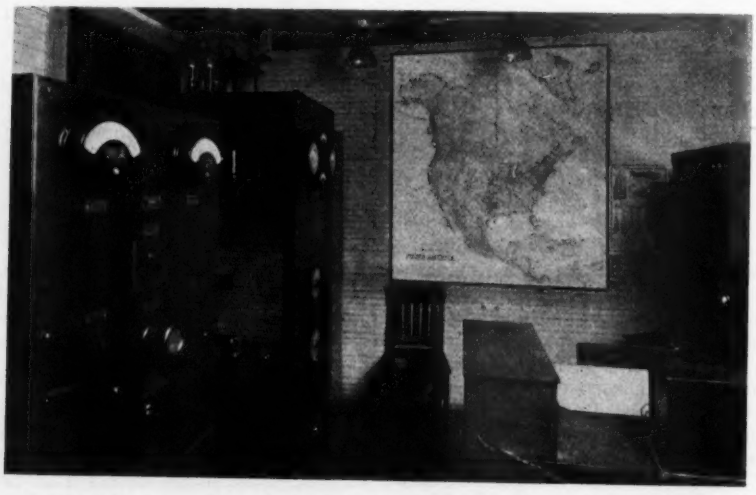
The writer did not know then, but presently found out that part of the testing would be of his moral courage and nerve force as he faced the new ordeal of speaking into a little microphone to an unseen audience of unknown number and sympathy.

The account of this experience will doubtless sound familiar to many who remember the first time they spoke over the radio. Approaching the hour of that first chapel service was enduring agony. There was little sleep Saturday night. There was less comfort Sunday morning. As the hour of 2:30 approached the chapel speaker was barely in possession of the strength to talk. With much floundering and great effort the talk was delivered to the air. The talker was as much in the air as the talk! But finally both came down. Fortunately the talk came down into receiving sets that were friendly and the speaker had an equally happy fate. That was the beginning of the writer's experience with broadcasting.

In about six weeks a suggestion was made by L. B. Henson, supervisor of the station, that consecutive Bible Study would be more valuable to many listeners than unconnected addresses. Consecutive Bible studies thereupon were begun, with the audience forming a Bible Class. The class undertook the study of the Epistle to the Ephesians verse by verse and section following section. Members of the class were asked to have their Bibles at hand and follow in the Scripture the reading and explanation of the passage. A flood of letters proclaimed the approval of the listeners. For several months, until December 10th in fact, the number of listeners increased with the natural growth of interest in radio generally, and many letters gave evidence of their presence in the Sunday afternoon audience.

Then came December 17th of last year, 1922. For the Bible Class it is an important date. It was this date that announcement was made to the listeners that the station personnel and the teacher of the class would enroll the names of all who would write in a request to be listed as members of what was believed to be the first enrolled Radio Bible Class. Adams Calhoun, the clear voiced announcer of WFAA, gave out the announcement. Immediately by telephone and telegraph came in the names and the WFAA Radio Bible Class was in existence.

To the best of our knowledge this marked the first organized Bible Class taught over the radio anywhere. It would be interesting to know from any readers if they have information of any earlier organized class. Many stations had taught Sunday School



The speckled map on one wall of WFAA's operating room registers the field covered by the transmitter. The station is heard throughout the United States, Mexico and Canada, east, west, north and south

lessons, and had chapel, and broadcast services before that date, but we have no knowledge of any earlier organization.

It was predicted that the enrollment might eventually go to three thousand or maybe five, and that we might have two thousand in the first thirty days. The names poured in. An effort was made at first to read aloud the names. One week 631 names came in. It was a hopeless task to read them all. We had no time left for announcements even. None for teaching. The reading had to be abandoned. Still the names for enrollment came in. Today, March 5th, as these words are written we are past the three thousand mark, and still enrolling with no indication of an end to it.

To each member of the class is sent a certificate handsomely printed, declaring that the person named is an enrolled member of the Class. The certificate bears the teacher's signature. It also is handicapped with his photograph.

The new ruling, or rather the request that stations observe the old ruling against personal communication has been accepted by WFAA and so the reading of names has been permanently discontinued, but two or three hundred new enrollments are received each week.

The Radio Bible Class started merely as a name to designate the transmission of a Bible lesson each Sunday, but like other good things, it quickly outgrew its tentative beginning. The radio audience began to consider itself to be the class, demanded enrolment of names, and so this membership card was provided. The original is 3½ by 5 inches in size.

Membership Certificate

This is to Certify that

is a member of the Radio Bible Class of Station WFAA, The Dallas News and The Dallas Journal, Dallas, Texas.

Teacher.

In several towns and cities there are local classes organized and group memberships sent in. Some of the groups have as high as one hundred members. These members of the Radio Class assemble together and with the aid of a loud speaker listen-in with all the thousands of others in smaller groups or singly.

Letters from invalids, shut-ins, and others who cannot get out to services show the interest in the growth and work of the Class. The orphans' homes of several nearby towns have receiving sets and belong to the class. Altogether the possibilities of its usefulness pass the limits of the most fertile imagination.

The *Dallas News* station is a Class B station having a 500-watt Western Electric equipment, which has, even in summer afternoons, a great range. And it is perfectly fitting for the writer to say that the fine spirited cooperation of the entire personnel of the station has made possible this service.

Belle Bart

(*Continued from page 33*)

you would answer them over the radio very loud and slowly, as I have a crystal set, Aeriola Junior, however it is a blessing to me.

Born, November 27, 1902.

1. Will I be useful in life?
2. Will my circumstances change?
3. Have I much more to live?

I thank you with all my heart for your very kind attention and may God reward you with health and happiness.

It is the problem that interests Miss Bart, the problem and the person and the signs in the sky.

What are these problems, who are the people, and what the signs?

The problems are infinite. Young people ask who they will marry, and when; or what jobs to seek; or how to become beautiful. Business men ask if the stars are propitious for new business ventures. Politicians scan the astrological as well as the political sky. Salesmen ("they must be very fond of changing their jobs," is Miss Bart's comment) want to know if they should make new connections. Women ask advice on marital and home questions. One who had found an Elk's pin asked who had lost it. Another desired to know how to locate the missing part of an incubator. "What will be the sex of my next child?" is a fairly frequent question. Dressmakers and milliners want to know if the time has come for them to go in business for themselves. In fact, employes in businesses ranging from candy to furniture, both men and women, put that problem up to the planets. The sick, weary of the burden of their ailments, would know the worst —or the best. Invalids of all ages write their dismay, and often of their vain hopes.

Musicians, inventors, artists, laborers, mechanics, writers, printers, stenographers . . . . the list could cover a full page in small type. The educated and the illiterate. The Governor's Lady and Judy O'Grady. The Governor himself, and Mr. O'Grady. Letters on brown manila scrap paper, scrawled in pencil. Letters on engraved stationery, daintily traced by cultured hands. Letters on business letterheads, written with stub pens, black, lavender, blue and red ink. It is astounding, the variety. It is a great cross section of mankind. No one class follows Belle Bart by radio, but members of all classes, and particularly those who are in such distress that they themselves can find no way out.

Those who expect fortune telling are to be disappointed, however. Questions such as those about the Elk's pin and incubator get nary an answer. No black magic is this. Belle Bart wears no flowing robes, and surrounds herself with no air of impenetrable mystery. Her studio is simply a luxuriously furnished room, with no trappings. Bound copies of the ephemerides, the astronomical calendar to be found in every astronomical observatory, giving the positions of the stars, alone distinguish the studio as the scene of unusual labors. Miss Bart impressed one as being an eager, enthusiastic young scientist—and no one who has heard her by radio can fail to realize her sincerity and the good she is doing hundreds of perplexed and distressed mortals.

Gay Mayor Hylan

(*Continued from page 39*)

Whalen broadcasted inviting his invisible audience to a celebration which we hope to make the greatest Civic Celebration of the Twenty-fifth Anniversary of the Greater City of New York.

No other medium could have obtained the results which Commissioner Whalen assures me were accomplished by your co-operation. He has been the recipient of letters and telegrams from persons thousands of miles distant from the City of New York.

Again extending my sincere thanks for your interest and co-operation, let me wish you every success.

Sincerely yours,
John F. Hylan.

New Hospital Installation

A RADIO receiving set is now in use in the new Beth Israel Hospital, New York City. The receiver is provided with 150 headphones and already has proven its value. "The patients have nothing but blank walls to stare at and nothing of which to think except their ailments," explains Louis J. Frank. "Radio is bound to help these patients."

Biggest Ship Has Biggest Radio

THE S. S. *Leviathan,* which sailed from New York on July 4 on its first trip to Europe after having been reconditioned by the United States Shipping Board, bore in its radio room the most complete and powerful radio apparatus ever placed on any ship.

The ship is so extraordinarily supplied with transmitting and receiving apparatus as to be a veritable seagoing radio central. In fact, it is far better equipped than many land stations were not so many years ago. No less than three separate transmitters are available and three receiving sets. The antennas that are strung in various directions over the ship are so arranged and the apparatus connected to them so tuned that it is possible to operate two transmitters and two receiving sets simultaneously without interference. This means, for instance, that the ship can talk by radio telephone with the shore on the duplex system and at the same time be carrying on radio telegraph traffic in both directions with another ship or shore station. When it is considered that in spite of the fact that the *Leviathan* is the largest ship afloat, the space available for radio purposes is necessarily but a fraction of that used by shore stations for carrying out exactly similar operations, it will be seen that the *Leviathan* installation represents an engineering triumph.

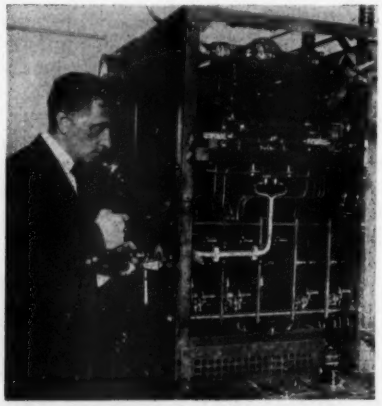
The most powerful transmitter is rated at 6 kw., an instrument using water-cooled tubes, and used for modulated CW transmission. Power is supplied from a 10 kw. Crocker-Wheeler motor generator. It is this set that gives the *Leviathan* a consistent range of some 6,000 miles, enabling it to keep in easy communication with both sides of the Atlantic Ocean continually during its voyages and also to reach ships far to the south. The transmitter puts 30 amperes into the antenna when working on 1,800 meters, 31 amperes on 2,100 meters, 29.5 amperes on 2,400 meters and 29 amperes on 2,500 meters. The antenna is 600 feet long and is a ten-inch cage at the top of the masts.

For duplex radio telephone work with other ships and with the shore, there is a 750-watt transmitter connected to a separate antenna 500 feet long. By the use of this transmitter and corresponding transmitting and receiving equipment on the shore or on another ship, it is possible for passengers on the *Leviathan* to use a telephone and talk through space with persons ashore and afloat, just as if they were using a land wire telephone. The receiving apparatus for this duplex telephone set uses an independent antenna running forward from one of the masts. A similar antenna running aft is used for receiving on long waves and is associated with the traffic handled by the 6 kw. set.

E. N. Pickerill, chief operator of the "Leviathan," at the radio telephone transmitter that allows two-way conversation between ship and shore

The third transmitter is a Navy Spark Type SE-1205 rated at 2 kw. It is not provided with a separate antenna, as this installation is designed to be somewhat of an emergency nature. When it is necessary to use it, it will be connected to the antenna normally used for the duplex telephone set. It is expected that practically the entire radio business handled by the *Leviathan* will go on either CW or ICW, using the two tube transmitters.

The power supply to this elaborate equipment is necessarily extensive and includes no less than three motor generators. There is also a special Exide storage battery, 125 volts, 240-ampere hours, which is maintained fully charged at all times for emergency work should the ship's dynamos be unable to supply the necessary power. This battery would make it possible for transmission to be carried on for four hours.



Testing the "Leviathan's" radio equipment; an RCA engineer at the telephone

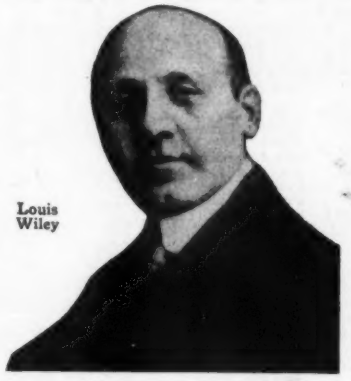
The installation of this remarkable radio equipment was completed by Radio Corporation engineers shortly before the ship made its trial voyage. During the trial trip, which lasted five days, a record volume of business was handled, a large proportion of this being press messages to newspapers and news associations, the public interest being great. In order to handle this volume of traffic it is necessary to use two transmitters and two receivers practically continuously. The radio operators, in fact, were about "done in" when the trial trip ended, each of them having averaged only four hours of sleep during the five days. During the trial run from Boston to Cuban waters and back to New York the ship had no difficulty whatsoever in working continually with Marion, Mass., the Marine Radio Central of the Radio Corporation of America, and with WNY, the Radio Corporation's station at Bush Terminal, New York. E. N. Pickerill is chief operator of the *Leviathan* and his assistants are A. C. Tamburinio, R. J. Green, H. F. Bollendonk, E. Engelder and C. R. Underhill.

(*See next page*)

Radio Supplements Newspapers

By Louis Wiley

Business Manager, New York "Times"



Louis Wiley

NEWSPAPERS have many problems—and multitudes of contact points with the world, from which to draw the information that will answer the questions that they and the public must ask. Radio when it extends—as it occasionally does—into the field of news dissemination cannot avoid the accusation of trespass. Yet that accusation has been heard far oftener from the business world than from the newspapers. And here is the business manager of what is easily one of America's great newspapers not only denying the harm of radio to the dailies, but going out of his way to pay a hearty and far-sighted tribute to the new art. Louis Wiley's remarks are taken from an address recently delivered before the School of Journalism, University of Missouri, Columbia, Mo.

"RADIO broadcasting will never take the place of newspapers. The newspaper can be read any time. We absorb such information as we desire from its columns when we are so inclined. If we miss a point we can go back to it. But if you desire entertainment or news by radio, you must take what is provided at the hour scheduled, not at the time and place you prefer and there can be no relistening to or reselection of radio transmitted news. You must seek the radio, but the newspaper comes to you.

"Dissemination of knowledge by radio will be in a new field. It will satisfy a demand that newspapers cannot fill and there will be room for the development of both. Radio transmission of news should tend to stimulate interest in newspapers and increase their sales.

"Radio will be a most effective agent in stemming the drift of people from the country to the cities. Country life has always had a certain amount of dullness in it, owing to the lack of entertainment. The radio set gives the news, the music, the drama and the talk to the whole countryside; so that in a few years it will make no difference where a man lives. He will be able to work anywhere, and yet know and hear what is going on in the chief centres of activity. Thus, the day may not be far distant when, instead of crowding into an ill-ventilated opera house as the one place where some Caruso may be heard, a million people will not only listen in their homes, but advances in science enable them to see the stage as well as hear the voice of the operatic star.

"Radio has come to stay. It is not a passing phase, and must be treated seriously, for its possibilities are numerous and important. Already I can visualize the time when all nations will listen to announcements of international consequence from the chief capitals: Tokio, Paris, Berlin, Rome, Moscow, London. A quarter of a century from now Washington may announce arrangements for broadcasting university courses in journalism open to all the world. I predict that within two or three hundred years the use of radio will have brought about a universal language; and whatever newspapers exist in those days will be printed in that tongue.

"Newspapers should take a favorable attitude toward radio, for many reasons. Broadcasting is now largely a neighborhood undertaking, frequently a very large neighborhood. People are able to get together and think of the same thing, in such groups as their preferences dictate. We are gregarious creatures, and radio as well as motion picture entertainments meet the fundamental human desire to get into touch with others.

"Radio represents a people's movement. Broadcasting has the nature of great university extension courses and it is already an educational force of tremendous power.

"Thousands of youths who have made their own receiving sets will grow up in a scientific atmosphere, and no development of the apparatus or extension of service will be foreign to them. The editor, taking a wider and deeper interest, cannot afford to ignore a factor which tends to unite the people of this country, and which brings all of them into touch with the wide world across the seas."

"Leviathan"

(*From preceding page*)

In addition to handling traffic to and from passengers on the *Leviathan*, and service messages connected with the operation of the ship, the radio operators are also relaying messages for other ships not possessed of sufficiently powerful radio apparatus to put them in communication with stations with which they desire to correspond. The great power of the *Leviathan* transmitter and sensitiveness of its receiving equipment make it possible for it to take traffic from ships at considerable distance in the north and south Atlantic and transfer the messages directly to other ships or to shore stations.

One new use to which the *Leviathan's* radio equipment will be put will be the transfer of money payments. The Farmers Loan & Trust Company, New York City, has established a branch office on the ship and will use radio in mid-ocean banking.

Giuseppe Danise

(*Continued from page* 34)

seem to want it to spring up a full grown industry. *Mais, il faut du temps,* why such impatience! As I said, *c'est merveilleux,* what has already been done. Now is the time for us to co-operate, with what has been accomplished to—as you say here in America—'back up' *l'avenir,* the future. *Allons!* Let's help all we can. Already, broadcasting is helpful as well as helped. One sings and that gives one *réclame.* People hear one who wouldn't do so in any other way; some of them are sure to go buy records, and when one gives a concert in their city they will say: 'Ah, yes, Danise, we've heard him by radio, let us go *see* him!' People are like that, *N'est-ce pas? Curiosité,* ah, that must be satisfied. *On ne m'a pas vu.* I must be seen as well as heard! *C'est l'humanité, tout simple! Alors, les billets,* the tickets, are sold!

"Another reason why I would like to sing for the radio—the *blessés,* the sick, the poor who cannot pay. *Tous à faire pitié.* For them I sing often with all my heart. Many artists, every artist has a heart full of concern for such, and when radio reaches them—*ah, quelle merveille!*

"Mais, c'est l'avenir qui nous concerne, l'avenir nous promet beaucoup, le présent étant si beau."

And with this parting thought for the future of radio, that much is promised because the present is so wonderful, Danise escorted me to the door.

Distant Broadcasting Stations Heard

Broadcasting fans daily surprise themselves and others by reaching out across hundreds of miles by a turn of the wrist. Often the most simple bulb equipment will produce astonishing results, as reported below. What have YOU done?

HOWARD ADAMS, JR., Shinnston, W. Va., in sending his list says: "There will undoubtedly be some people who will question the fact that I include Brazil and England in the list, but I can swear to the correctness of the list. All stations were heard on a Magnavox loud speaker with enough volume to be heard all over a fair-sized room." Adams uses a Paragon RA-10 tuner and the Paragon DA-2, the detector and two step audio amplifier.

KOA	Denver, Colo.	1,325 Miles
WKY	Oklahoma City, Okla.	1,025 Miles
CFCN	Calgary, Canada	2,000 Miles
WEAV	Rushville, Neb.	1,200 Miles
KFAF	Denver, Colo.	1,325 Miles
KDYX	Honolulu, T. H.	4,600 Miles
KGG	Portland, Ore.	2,250 Miles
KGW	Portland, Ore.	2,250 Miles
KPO	San Francisco, Calif.	2,350 Miles
WLAY	Fairbanks, Alaska	3,500 Miles
KLB	Pasadena, Cal.	2,175 Miles
KFBV	Colorado Springs, Col.	1,325 Miles
WBAP	Fort Worth, Texas	1,075 Miles
KGU	Honolulu, T. H.	4,600 Miles
KDYS	Great Falls, Mont.	1,675 Miles
WGAR	San Antonio, Texas	1,275 Miles
KZN	Salt Lake City, Utah	1,675 Miles
SPC	Rio de Janeiro, Brazil	5,000 Miles
CHCF	Winnipeg, Canada	1,150 Miles
PWX	Havana, Cuba	1,400 Miles
5KW	Tuinucu, Cuba	1,400 Miles
WEAD	Atwood, Kansas	1,150 Miles
WFAA	Dallas, Texas	1,050 Miles
2LO	London, England	3,100 Miles
WOAI	San Antonio, Texas	1,275 Miles
KWH	Los Angeles, Calif.	2,200 Miles
KFI	Los Angeles, Calif.	2,200 Miles
WKAQ	San Juan, P. R.	1,400 Miles
CHBC	Calgary, Canada	2,000 Miles
KFEC	Portland, Ore.	2,250 Miles

FERGUS MCKERVER, Chicago, Ill., sends in the following list of stations heard while he lived in Lawrence, Kan., using a Grebe CR-9 receiver:

WGAD	Ensanada, P. R.	2,200 Miles
PWX	Havana, Cuba	1,400 Miles
CKCK	Regina, Canada	1,000 Miles
KWH	Los Angeles, Cal.	1,350 Miles
KUO	San Francisco, Cal.	1,450 Miles
KLX	Oakland, Cal.	1,425 Miles
KGG	Portland, Ore.	1,500 Miles
WMV	Belfast, Me.	1,400 Miles
CKCD	Vancouver, B. C.	1,700 Miles
WKAZ	Bridgeport, Conn.	1,300 Miles
KGW	Portland, Ore.	1,500 Miles
WDM	Washington, D. C.	1,000 Miles
CFCF	Montreal, Canada	1,350 Miles
KTA	San Francisco, Cal.	1,450 Miles
KDNT	Bakersfield, Cal.	1,400 Miles
WDAI	Syracuse, N. Y.	1,050 Miles
KYF	San Diego, Cal.	1,300 Miles
WBAB	Syracuse, N. Y.	1,050 Miles
KNX	Los Angeles, Cal.	1,350 Miles
WEAR	Baltimore, Md.	1,100 Miles
NAA	Arlington, Va.	1,000 Miles
KFC	Seattle, Wash.	1,600 Miles
WAAQ	Greenwich, Conn.	1,300 Miles
KFAS	Reno, Nev.	1,300 Miles
WGR	Buffalo, N. Y.	1,000 Miles
WJAR	Providence, R. I.	1,000 Miles
CKKC	Toronto, Canada	1,000 Miles
KDQO	San Francisco, Cal.	1,450 Miles
WGY	Schenectady, N. Y.	1,100 Miles
KFI	Los Angeles, Cal.	1,350 Miles
WBAY	New York City	1,200 Miles
WDAE	Tampa, Fla.	1,000 Miles
WDY	Roselle Park, N. J.	1,200 Miles
WIP	Philadelphia, Pa.	1,100 Miles
WLAW	New York City	1,200 Miles
WJZ	Newark, N. J.	1,200 Miles
WFI	Philadelphia, Pa.	1,100 Miles
KFBK	Sacramento, Cal.	1,400 Miles
WSC	Siasconset, Mass.	1,300 Miles
KFAN	Moscow, Idaho	1,200 Miles
WMAL	Trenton, N. J.	1,200 Miles
KDZA	Phoenix, Ariz.	1,050 Miles
WAAM	Newark, N. J.	1,200 Miles
KFAB	Portland, Ore.	1,500 Miles
WBZ	Springfield, Mass.	1,300 Miles
WEAF	New York City	1,200 Miles
KFAR	Hollywood, Cal.	1,350 Miles
KLS	Oakland, Cal.	1,425 Miles
WJH	Washington, D. C.	1,000 Miles
WEAA	Flint, Mich.	1,000 Miles
WHAM	Rochester, N. Y.	1,050 Miles
CHBC	Calgary, Canada	1,300 Miles
WBAG	Bridgeport, Conn.	1,300 Miles
WEAM	Plainfield, N. J.	1,200 Miles
WDAR	Philadelphia, Pa.	1,000 Miles
WEAS	Washington, D. C.	1,000 Miles
QEAI	Ithaca, N. Y.	1,050 Miles
WBAN	Paterson, N. J.	1,200 Miles
KDYW	Phoenix, Ariz.	1,050 Miles
KYY	San Francisco, Cal.	1,450 Miles
KJS	Los Angeles, Cal.	1,350 Miles
KDYR	Pasadena, Cal.	1,350 Miles
KHJ	Los Angeles, Cal.	1,350 Miles
KZC	Seattle, Wash.	1,600 Miles

Since moving to Chicago he has heard the following:

KDYX	Honolulu, T. H.	5,000 Miles
KPO	San Francisco, Cal.	2,250 Miles
KFDB	San Francisco, Cal.	2,250 Miles
KSS	Long Beach, Cal.	2,150 Miles
KHJ	Los Angeles, Cal.	2,150 Miles
KFI	Los Angeles, Cal.	2,150 Miles
WGAD	Porto Rico	2,100 Miles
PWX	Havana, Cuba	1,300 Miles
KDYS	Great Falls, Mont.	1,350 Miles
KZN	Salt Lake City, Utah	1,350 Miles
KOB	State College, New Mexico	1,350 Miles
KFAE	Pullman, Wash.	1,500 Miles
KGW	Portland, Ore.	2,000 Miles
WOAI	San Antonio, Tex.	1,100 Miles
KDYL	Salt Lake City, Utah	1,350 Miles

BRYANT TOMM, Muskogee, Okla., has heard as many as 52 stations in a single night. He uses a Mu-Rad radio frequency receiver and a 14-inch loop.

KDYX	Honolulu, T. H.	3,610 Miles
CHCA	Vancouver, B. C.	1,727 Miles
WLAN	Houlton, Maine	1,500 Miles
PWX	Havana, Cuba	1,400 Miles

JOSEPH J. OSWALD, Trenton, N. J., had logged 207 different stations up to May 27, 1923, and was still going strong. He uses a single tube, and a high antenna.

CHOC	Vancouver, B. C.	2,600 Miles
KGW	Portland, Ore.	2,600 Miles
KLD	Los Altos, Cal.	2,600 Miles
KLS	Oakland, Cal.	2,600 Miles
KFDJ	Corvallis, Ore.	2,600 Miles
KFI	Los Angeles, Cal.	2,500 Miles
KHJ	Los Angeles, Cal.	2,500 Miles
CFCN	Calgary, Alta.	2,200 Miles
WEX	Wichita, Kan.	1,700 Miles
KFCK	Colo. Spring, Colo.	1,600 Miles
KFDL	Denver, Colo.	1,600 Miles
KLZ	Denver, Colo.	1,600 Miles
KHD	Colo. Springs, Colo.	1,600 Miles
WKAQ	Essenda, P. R.	1,500 Miles
WOAZ	Stanford, Tex.	1,500 Miles
WOAQ	Abilene, Tex.	1,500 Miles
PWX	Havana, Cuba	1,400 Miles
SKW	Tunicu, Cuba	1,400 Miles
WKX	Okla. City, Okla.	1,400 Miles
WFAA	Dallas, Tex.	1,400 Miles
WKAF	Wichita Falls, Tex.	1,400 Miles
WBAP	Ft. Worth, Tex.	1,400 Miles
WGAF	Tulsa, Okla.	1,300 Miles
WBL	Anthony, Kan.	1,300 Miles
WLAL	Tulsa, Okla.	1,300 Miles
WDAY	Fargo, N. D.	1,200 Miles
WOAW	Omaha, Neb.	1,200 Miles
KSD	St. Louis, Mo.	1,000 Miles
WHB	Kan. City, Mo.	1,000 Miles
WCAL	Northfield, Minn.	1,000 Miles
WDAF	Kan. City, Mo.	1,000 Miles
WJAD	Duluth, Minn.	1,000 Miles
WCAN	Penas, Fla.	1,000 Miles
WGF	Des Moines, Ia.	1,000 Miles
WIAS	Burlington, Ia.	1,000 Miles
WKN	Memphis, Tenn.	1,000 Miles
WLAG	Minneap., Minn.	1,000 Miles
WLAT	Burlington, Ia.	1,000 Miles
WMAJ	Kan. City, Mo.	1,000 Miles
WMAT	Duluth, Minn.	1,000 Miles
WOC	Davenport, Ia.	1,000 Miles
WOS	Jefferson C., Mo.	1,000 Miles
WEAB	Ft. Dodge, Neb.	1,000 Miles

SPENCER ROACH, Philadelphia, Pa., has heard so many distant stations that he has mimeographed his list for mailing to 100 of the broadcasting stations as a way of expressing his thanks. Some of the more distant stations thanked in this manner by Mr. Roach were:

WBAP	Fort Worth, Tex.	1,350 Miles
KDYL	Salt Lake City	2,000 Miles
WDAF	Kansas City	1,050 Miles
PWX	Havana, Cuba	1,250 Miles
WEAU	Sioux City, Ia.	1,150 Miles
WKY	Oklahoma City	1,300 Miles
KLZ	Denver	1,650 Miles
KPO	San Francisco	2,600 Miles
WRAU	Amarillo, Tex.	1,550 Miles
CJCA	Edmonton, Alberta	2,075 Miles
WHB	Kansas City	1,050 Miles
WJAG	Norfolk, Nebr.	1,200 Miles
WDAH	El Paso, Tex.	1,900 Miles
5KW	Tuinucu, Cuba	1,250 Miles
WOAW	Omaha, Nebr.	1,200 Miles
WDAI	San Antonio, Tex.	1,550 Miles
WRR	Dallas, Tex.	1,325 Miles
WOK	Pine Bluff, Ark.	1,050 Miles
WAAC	New Orleans	1,150 Miles
WLAG	Minneapolis	1,000 Miles

Alice Mills

(*Continued from page* 32)

mobiles and just miles and miles of roadhouses, all jumbled up in a terrific mess. Compositely, the highly moral doctor.

"Then the thought-movie of a film actress, one of those awful creatures that he wants to reform, you know. Well, that would show nothing but some lambs gamboling on the lawn, and a dainty little home and mother, and just the hardest kind of work in the studio, trying to please the great big public. Everything just sweet."

We grinned. "Say, those reformer's thoughts might teach the world a thing or two, what?"

Alice tapped her foot on the floor in gentle reproof. "When I came from Pittsburgh to study singing here in New York, and then had a sudden chance to go into the movies, everybody warned me against the bad company I would get in. But I haven't found it true at all. Everybody I have met has been perfectly charming and as nice as can be, and if these newspaper stories are true about photographing thoughts I think it would be simply splendid of the radio people if they would arrange to transmit some movie actor's thoughts and show everybody just how good we all are, really, when you get to know us and see us as we are."

Alice, we take it, judges others by herself. But we, who are more experience in the ways of the world, only hope that when thought photography begins in earnest somebody will have invented some kind of camphor in which thoughts, certain thoughts, that is, can be laid away, safe from photomoths, and yet not so safe that they can't be thought again once in a while, not out loud, but just for old time's sake.

Radio, M.D.

LAST December a radio receiver was presented to Benjamin A. Kelly, a tubercular patient at Saranac Lake, N. Y. This gift, originally intended only to help Kelly pass the time, is having an important effect on his health, according to the following letter from him to the person who gave him the set:

"You sure have been very kind to me and I appreciate it more than the ordinary fellow would. The radio gift was the only bright spot in my three years here; I sure had tough breaks right along and was beginning to brood over it. Since Christmas last I certainly have changed and I can only attribute it to the radio. I am up and around now and not in bed as before. Every time I see a bed patient with a radio set I rejoice with him or her, for I know just how they feel and how they will feel as time passes."

When There's Laughter on the Radio Wave

Radio Mother Goose

Jack and Jill went up the hill
To stretch a wire of copper;
Jack fell down and broke the bulb,
And Jill had to use a cat's whisker.

Solomon Grundy,
Bitten on Monday,
Crystal on Tuesday,
Tube on Wednesday,
Two-step Thursday,
Reflex Friday,
Broke on Saturday,
Crystal on Sunday,
That was the end of Solomon Grundy!

Seesaw, Margery Daw,
Borrowed some money off'n her Paw,
Bought the parts and made her a set—
Margery hasn't heard a darn thing yet!

Jack Sprat would hear no music,
His wife, no addresses,
So he bought two sets to listen at—
Gosh! How the evening passes!

Humpty Dumpty sat on the wall,
Humpty Dumpty heard a new call,
But all the King's horses
And all the King's men
Couldn't tune that station in again.

A diller, a dollar, a ten o'clock scholar,
What makes you so sleepy of late?
I used to go to bed at six,
But now I listen in 'til eight.

Peter, Peter, Pumpkin Eater,
Had a wife and couldn't keep her.
He installed a set in the pumpkin shell,
She's been home nights now, for quite a spell.

Set be nimble, set be quick,
Set jump over the Pa-cif-ic!

Little Jack Horner
Sat in a corner,
Tuning his radio;
He turned the dial 'round
And got a loud sound,
Atta baby, 'twas KPO!

Bye, Baby Bunting,
Daddy's gone a-hunting
With his portable station.
Jiminy, what a vacation!

Mary had a radio,
Its dials were black as ink;
And everywhere that Mary went—
(Well, what do you think?)

There was a man in our town
Who was so wondrous wise,
He jumped into a bramble bush
And scratched out both his eyes.
When he found his sight was gone
"No matter, sir," cried he.
"As long as I can listen-in,
"Whyever should I see?"

Hey diddle diddle,
The cat and the fiddle,
The cow jumped over the moon—
For both these features by radio
Hear XYZ at noon.

Tom, Tom, the piper's son,
Learned to play when he was young;
"When I can pipe like Dad," said he,
"I will play for WJZ."

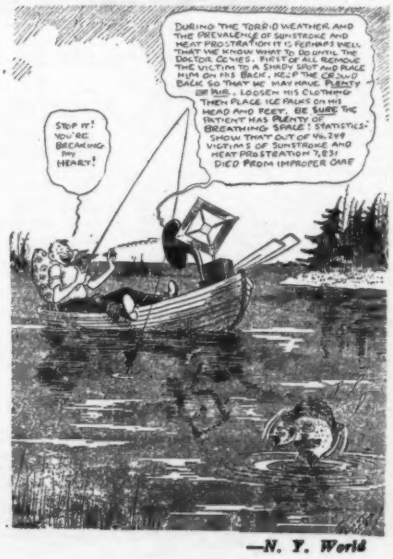
Old Mother Hubbard went to the cupboard
To get her poor set a transformer;
When she got there the cupboard was bare,
And the evening's performer did mourn her.

Little Miss Muffet
Sat on a tuffet,
Listening to KDKA;
When a neighboring Boiled Owl
Heterodyned her a howl
And frightened Miss Muffet away.

Hush-a-bye, baby, on the tree top!
When the wind blows the cradle will rock;
When the bough breaks the cradle will fall,
And down you'll come, kiddo, receiver and all.

—S. W. S.

MUSIC **By H. T. WEBSTER**


DURING THE TORRID WEATHER AND THE PREVALENCE OF SUNSTROKE AND HEAT PROSTRATION IT IS PERHAPS WELL THAT WE KNOW WHAT TO DO UNTIL THE DOCTOR COMES. FIRST OF ALL REMOVE THE VICTIM TO A SHADY SPOT AND PLACE HIM ON HIS BACK. HELP THE GROUND BACK SO THAT WE MAY HAVE PLENTY OF AIR. LOOSEN HIS CLOTHING THEN PLACE ICE PACKS ON HIS HEAD AND FEET. BE SURE THE PATIENT HAS PLENTY OF BREATHING SPACE! STATISTICS SHOW THAT OUT OF 46,249 VICTIMS OF SUNSTROKE AND HEAT PROSTRATION 2,831 DIED FROM IMPROPER CARE
STOP IT! YOU'RE BREAKING MY HEART!

—N. Y. World

Wise Crack-les

If Washington had lived in these times, he probably would have broadcast that silver dollar across the Potomac by radio.

And Paul Revere, instead of galloping through the night would have pounded a CQ msg. through a vicious brass key.

Demosthenes would be "Announcer D" at Greek Radio Broadcast Central.

That bout between David and Goliath would be broadcast direct from the scene by an eye-witness.

Captain Kidd would be running a cut-price radio shop.

Columbus would be in great demand for radio travelogues.

Lady Godiva would deliver a radio lecture on "First Lessons in Bareback Riding."

Jonah would be the radio operator on a whaleback.

If Nero wanted to call attention to his fiddling today he would burn the filaments in a radio transmitter instead of burning Rome.

Some artists seem to think that an invitation to give a radio recital is the modern equivalent of the cry that made Rome famous: "The Christians to the lions!"

When a singer begins to talk to the radio audience, it's a sign she's not so sure she has a good voice, after all.

Announcer: "We take great pleasure in introducing the famous violinist, Pslipskroww Sxfttamitch, who is an Auer pupil."

Radio Audience (17.759 per cent. of it). 'Gosh, an hour! Hey, Willie, see if you can tune in some jazz somewhere, we don't want no hour of fiddling."

The Nimble Wit of the Nation's Cartoonists

DISTANCE LENDS ENCHANTMENT

By SOL HESS

HELLO, RUDY — BEEN SHOPPING? WHAT'VE YOU GOT IN THE BOX?
JUST A LITTLE PRESENT FOR JUNIOR — HE'S BEEN BOTHERING ME FOR A RADIO
WHAT DO YOU EXPECT TO CATCH WITH THAT PILL BOX? IF THEY WERE BROADCASTING A THUNDER STORM ALL YOU'D GET WOULD BE THE LIGHTNING AND YOU CAN SEE THAT
COME OVER TO THE HOUSE SOME NIGHT I'LL SHOW YOU A REAL OUTFIT THAT WILL PICK UP SOUND FOR A FEW THOUSAND MILES — I PICKED UP A MESSAGE FROM GREENLAND THE OTHER DAY AND WHEN IT WAS OVER I FOUND FROST ON THE HORN
THAT GUY FARWELL WOULD RATHER HEAR A MOSQUITO SNEEZE IN CUBA THAN GRAND OPERA A FEW MILES AWAY — IF THEY HAD A SMALL-POX EPIDEMIC IN HAWAII HE'D BE GLAD TO CATCH IT IF HE COULD SAY HE GOT IT OVER THE RADIO

—San Francisco Examiner

SAPPO

By SEGAR

MR. TIMBER SAYS THAT RADIO IS BECOMING MORE POPULAR EVERY DAY
I HAVEN'T USED MY RADIO FOR A LONG TIME - GUESS I'LL TUNE IN SOMETHING
SOUNDS ALL JUMBLED UP - I CAN'T GET A WORD OF THIS SONG
I DON'T FIND A THING WRONG WITH IT - I'LL PUT IT BACK TOGETHER AND TRY IT AGAIN
STILL TERRIBLE - I CAN'T CATCH ONE WORD
THE NEXT SONG IN POLISH - WILL BE —

—N. Y. Journal

THE LAST STAGES ARE INCURABLE

By HAENIGSEN

HA! THAT'S FINE! CLEAR AS A BELL AN' SWEET AS HONEY - ONLY NOT QUITE LOUD ENOUGH - I'LL ADD ONE STEP OF AMPLIFICATION AND THEN LEAVE IT ALONE!
I'LL SAY THAT'S AN IMPROVEMENT!!! STILL A LITTLE WEAK THOUGH WITH TWO STEPS I OUGHTA GET SOME REAL VOLUME!
SWEET PICKLES! HEAR THAT COME IN! IF IT'S THIS LOUD ON TWO STEPS - WHAT'LL THAT SUPER-SUPER-SLOPOVER CIRCUIT DO??
THERE'S A SET! IT HAS SO MANY CONTROLS - I CAN'T TUNE ANYTHING IN BUT I'D LIKE TO SEE IT'S EQUAL FOR DISTANCE - AND MAN! YOU CAN HEAR IT TWO BLOCKS AWAY. HERE'S A SET TO ENJOY.
ROWR
AK-AK-AK
YEOW

—N. Y. Evening World

THE THIMBLE THEATER

By SEGAR

—N. Y. Journal

INDOOR SPORTS

By TAD

THAT OLD NUT AT THE MACHINE IS THE BUSIEST GUY IN THIS JOINT
HE'S A RADIO NUT - HE WRITES TO EVERY PERSON WHO DOES ANY KIND OF AN ACT ON THE RADIO
IF THE POSTOFFICE DON'T PAY IT AIN'T HIS FAULT
SHALL I WAIT FOR THAT ONE HE HALLOED AT?
YES-YES — THAT ONE IS TO THE MAN WHO TALKED ABOUT HIS PILLS AND PAINS
INDOOR SPORTS
WATCHING CRYSTAL SET CHARLIE AS HE WRITES TO ALL THE RADIO ENTERTAINERS HE KNOWS!

—N. Y. American

LIFE ON THE RADIO WAVE

By PINTO

IT WAS BAD ENOUGH FOR "INSOMNIA SLIM" TO HAPPEN ON TO THAT DISCARDED DINING CAR MENU - BUT, WHEN "HOME SWEET HOME" CAME OVER THE AIR, THAT WAS CARRYING THINGS A LITTLE TOO FAR —.
A LEMON CREAM PIE THAT MOTHER USED TO MAKE
AH! THERE'S NO SUCH PLACE LIKE HOME!
YUM YUMS

—San Francisco Chronicle

BROADCASTING STATION DIRECTORY

(Revised to July 14th, 1923)

KAO	Young Men's Christian Association, Denver, Colo.		360
KFI	E. C. Anthony	Los Angeles, Calif.	469
KFZ	Deerr Mitchell Electric Co.	Spokane, Wash.	283
KGB	Wm. A. Mullins Electric Co.	Tacoma, Wash.	360
KGC	Hallock & Watson Radio Service,	Portland, Ore.	360
KGW	Northwestern Radio Mfg. Co.	Portland, Ore.	360
KGY	Altadena Radio Laboratory	Altadena, Calif.	360
KGO	M. A. Muirey	Honolulu, Hawaii	360
KGW	Oregonian Pub. Co.	Portland, Ore.	492
KGY	St. Martins College	Lacey, Wash.	258
KHJ	Times Mirror Co.	Los Angeles, Calif.	395
KHQ	Louis Wasmer	Seattle, Wash.	360
KJI	The Radio Shop	Sunnyvale, Calif.	360
KJR	C. O. Gould	Stockton, Calif.	360
KLS	Northwest Radio Service Co.	Seattle, Wash.	270
KLS	Bible Institute of Los Angeles, Inc.,	Los Angeles, Calif.	360
KLN	Monterey Electric Shop	Monterey, Calif.	261
KLS	Warner Brothers	Oakland, Calif.	360
KLX	Tribune Publishing Co.	Oakland, Calif.	360
KLZ	Reynolds Radio Co.	Denver, Colo.	360
KMC	Lindsay-Weatherill & Co.	Readley, Calif.	360
KMJ	San Joaquin Light & Power Co.	Fresno, Calif.	360
KOMO	Love Electric Co.	Seattle, Wash.	360
KNI	E. W. Smith	Eureka, Calif.	360
KNJ	Roswell Public Service Co.	Roswell, N. M.	360
KNN	Bullock's	Los Angeles, Calif.	360
KNT	Grays Harbor Radio Co.	Aberdeen, Wash.	263
KNV	Radio Supply Co.	Los Angeles, Calif.	360
KNX	Electric Lighting Supply Co.	Los Angeles, Calif.	360
KOA	T. M. C. A.	Denver, Colo.	360
KOB	New Mexico College of Agriculture and Mechanical Arts,	State College, N. Mex.	360
KOP	Detroit Police Dept.	Detroit, Mich.	258
KOS	Modesto Evening News	Modesto, Calif.	360
KPG	Hale Bros.	San Francisco, Calif.	423
KQI	University of California	Berkeley, Calif.	360
KQP	Apple City Radio Club	Hood River, Ore.	360
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.	360
KQW	Charles D. Herreld	San Jose, Calif.	360
KRE	Maxwell Electric Co.	Berkeley, Calif.	360
KSD	Post-Dispatch	St. Louis, Mo.	546
KTB	The Emporium	San Francisco, Calif.	360
KUS	Frost & Dean Radio Rsch. Lab.	Long Beach, Calif.	360
KTW	First Presbyterian Church	Seattle, Wash.	360
KUO	The Examiner Printing Co.	San Francisco, Calif.	360
KUS	City Dye Works & Laundry Co.	Los Angeles, Calif.	360
KUY	Coast Radio Co.	Del Monte, Calif.	360
KWG	Portable Wireless Telephone Co.	Stockton, Calif.	360
KWH	Los Angeles Examiner	Los Angeles, Calif.	360
KXD	Herald Publishing Co.	Modesto, Calif.	360
KYS	Electric Shop	Honolulu, T. H.	360
KYW	Westinghouse Elec. & Mfg. Co.	Chicago, Ill.	345
KZM	Preston, D. Allen	Oakland, Calif.	360
KZN	The Desert News	Salt Lake City, Utah	360
KZV	Wenatchee Battery & Motor Co.	Wenatchee, Wash.	360
KDKA	Westinghouse Elec. & Mfg. Co.	Pittsburgh, Pa.	326
KDPM	Westinghouse Elec. & Mfg. Co.	Cleveland, Ohio	270
KDPT	Southern Electric Co.	San Diego, Calif.	360
KDYL	Telegram Publishing Co.	Salt Lake City, Utah	360
KDYN	Savoy Theatre	San Diego, Calif.	252
KDYQ	Oregon Institute of Technology	Portland, Ore.	360
KDYS	The Tribune, Inc.	Great Falls, Mont.	360
KDYW	Smith, Hughes & Co.	Phoenix, Ariz.	360
KDYX	Star Bulletin Publishing Co.	Honolulu, T. H.	360
KDZB	Frank E. Siefert	Bakersfield, Calif.	360
KDZE	The Rhodes Co.	Seattle, Wash.	360
KDZF	Automobile Club of So. Calif.,	Los Angeles, Calif.	278
KDZB	Cyrus Peirce & Co.	San Francisco, Calif.	360
KDZI	Electric Supply Co.	Wenatchee, Wash.	360
KDZK	Nevada Machinery & Electric Co.	Reno, Nev.	360
KDZR	Pyle & Nichols	Denver, Colo.	360
KDZB	Bellingham Publishing Co.	Bellingham, Wash.	261
KDZT	Seattle Radio Association	Seattle, Wash.	360
KDZU	Western Radio Corporation	Denver, Colo.	360
KDZV	Cope & Cornwell Co.	Salt Lake City, Utah	360
KDZW	Glad Tidings Tabernacle	San Francisco, Calif.	360
KFAD	McArthur Brothers Mercantile Co.	Phoenix, Ariz.	360
KFAE	State College of Washington	Pullman, Wash.	360
KFAF	Western Radio Corporation	Denver, Colo.	360
KFAJ	University of Colorado	Boulder, Colo.	360
KFAM	Electric Shop	Moscow, Idaho	360
KFAP	Standard Publishing Co.	Butte, Mont.	360
KFAQ	City of San Jose	San Jose, Calif.	360
KFAR	O. K. Olsen	Hollywood, Calif.	360
KFAT	Dr. J. T. Donohue	Eugene, Ore.	275
KFAW	The Radio Den, Ashford & White,	Santa Anna, Calif.	360
KFAU	Independent School District of Boise City,	Boise, Idaho	270
KFAV	Abbot Kinney Company	Venice, Calif.	258
KFAY	W. J. Virgin Milling Co.	Central Point, Ore.	360
KFBB	F. A. Buttrey & Co.	Havre, Mont.	360
KFBC	W. K. Azbill	San Diego, Calif.	360
KFBD	Clarence V. Welch	Hanford, Calif.	360
KFBE	Reuben H. Hern	San Luis Obispo, Calif.	360
KFBK	Kimball-Upson Co.	Sacramento, Calif.	360
KFBL	Loose Bros.	Everett, Wash.	224
KFBS	Chronicle News and Gas & Elec. Supply Co.,	Trinidad, Colo.	360
KFBU	Bishop N. S. Thomas	Laramie, Wyo.	360
KFCB	Nielsen Radio Supply Co.	Phoenix, Ariz.	360
KFCD	Salem Elec. Co.	Salem, Ore.	360
KFCF	Frank A. Moore	Walla Walla, Wash.	360
KFCH	Electric Service Station	Billings, Mont.	360
KFCK	Colorado Springs Radio Co.,	Colorado Springs, Colo.	360
KFCL	Los Angeles Union Stock Yds.	Los Angeles, Calif.	360
KFCM	Richmond Radio Shop	Richmond, Calif.	360
KFCP	Ralph W. Flygare	Ogden, Utah	360
KFCR	Motor Service Station	Casper, Wyo.	360
KFCU	Fred Mahaffey, Jr.	Houston, Tex.	360
KFCV	Western Union College	Le Mars, Iowa	360
KFCZ	Omaha Central High School	Omaha, Nebr.	360
KFDB	Adler's Music Store	Baker, Ore.	360
KFDC	Mercantile Trust Co.	San Francisco, Calif.	509
KFDD	Radio Supply Co.	Spokane, Wash.	283
KFDE	St. Michaels Cathedral	Boise, Idaho	360
KFDF	Wyoming Radio Corp.	Casper, Wyo.	360
KFDH	University of Arizona	Tucson, Ariz.	360
KFDJ	Oregon Agri. College	Corvallis, Ore.	360
KFDL	Knight-Campbell Music Co.	Denver, Colo.	360
KFDO	H. E. Cutting	Boseman, Mont.	248
KFDP	Hawkeye Radio & Supply Co.	Des Moines, Ia.	278
KFDR	Bullock's Hardware & Sporting Goods,	York, Nebr.	360
KFDU	Nebraska Radio and Electric Co.,	Lincoln, Nebr.	240
KFDV	Gilbrech & Stinson	Fayetteville, Ark.	360
KFDX	First Baptist Church	Shreveport, La.	360
KFDY	South Dakota State College of Agri. & Mech. Arts,	Brookings, S. D.	360
KFDZ	Harry O. Iverson	Minneapolis, Minn.	360
KFEB	The City of Taft	Taft, Calif.	360
KFEC	Meier & Frank Co.	Portland, Ore.	360
KFEJ	Guy Greason	Tacoma, Wash.	360
WFEL	Winner Radio Corporation	Denver, Colo.	360
KFEP	Radio Equipment Co.	Denver, Colo.	240
KFEQ	J. L. Scroggin	Oak, Nebr.	360
KFFR	Auto Electric Service Co.	Ft. Deore, Iowa	231
KFEV	Radio Electric Shop	Douglas, Wyo.	283
KFEX	Augsburg Seminary	Minneapolis, Minn.	261
KFEY	Bunker Hill & Sullivan Mining & Const. Co.,	Kellogg, Idaho	360
KFEZ	American Society of Mech. Engrs.	St. Louis, Mo.	360
KFFA	Dr. R. O. Shelton	San Diego, Calif.	242
KFFB	Jenkins Furniture Co.	Boise, Idaho	360
KFFE	Eastern Oregon Radio Co.	Pendleton, Ore.	360
KFFJ	Jenkins Furniture Co.	Boise, Idaho	360
KFFO	Dr. E. H. Smith	Hillsboro, Oregon	229
KFFP	First Baptist Church	Moberly, Mo.	275
KFFQ	Markschoffel Motor Co.	Colorado Springs, Colo.	360
KFFR	Jim Kirk	Sparks, Nev.	360
KFFV	Graceland College	Lamoni, Iowa	360
KFFX	McGraw Co.	Omaha, Nebr.	278
KFFY	Pincus & Murphy, Inc.	Alexandria, La.	275
KFFZ	Al. G. Barnes Amusement Co.	Dallas, Tex.	226
KFGB	Loewenthal Brothers	Pueblo, Colo.	360
KFGC	Louisiana State University	Baton Rouge, La.	254
KFGD	Chickasha Radio & Elec. Co.	Chickasha, Okla.	246
KFGF	Buchanan Stevens & Co.	Mt. Vernon, Wash.	360
KFGH	Leland Stanford, Jr., Univ.	Stanford Univ., Colo.	360
KFGJ	National Guards Mo., 138th Inf.	St. Louis, Mo.	266
KFGL	Arlington Garage	Arlington, Ore.	234
KFGP	Cheney Radio Co.	Cheney, Kans.	229
KFGQ	Crary Hdw. Co.	Boone, Iowa	226
KFGV	Heidbreder Radio Supply Co.	Utica, Nebr.	224
KFGX	First Presbyterian Church	Orange, Tex.	250
KFGY	Gjelbaug's Radio Shop	Baudette, Minn.	224
KFGZ	Emmanuel Missionary Co.	Berrien Spgs., Mich.	286
KFHA	Colorado State Normal School	Gunnison, Colo.	360
KFHB	The Rialto Theatre	Hood River, Oregon	280
KFHD	Utz Electric Co.	St. Joseph, Mo.	226
KFHF	Central Christian Church	Shreveport, La.	206
KFHH	Ambrose A. McCue	Neah Bay, Wash.	283
KFHI	Charles V. Dixon	Wichita, Kans.	224
KFHJ	Fallon Co.	Santa Barbara, Calif.	360
KFHL	Penn College	Oskaloosa, Iowa	227
KFHQ	Curtis Brothers Hardware Store,	Los Gatos, Calif.	242
KFHP	Radio Bub Products Co.	Kearney, Nebr.	246
KFHR	Star Elec. and Radio Co.	Seattle, Wash.	360
KFHS	Clifford J. Dow	Lihue, Hawaii	275
KFIA	Franklin W. Jenkens	St. Louis, Mo.	244
KFIC	Philip Laskowitz	Denver, Colo.	224
KFID	Ross Arbuckles Garage	Iola, Kans.	246
KFIF	Benson Tech. Student Body	Portland, Ore.	360
KFIJ	Sidney I. Thoreau	Platte, S. D.	236
KFIK	Gladbrook Electric Co.	Gladbrook, Iowa	234
KFIL	Windisch Elec. Farm Equipment Co.,	Louisburg, Kans.	244
KFIQ	Yakima Valley Radio Broadcasting Association,	Yakima, Wash.	224
KFJA	Central Power Co.	Brand Island, Nebr.	244
KFJB	Marshall Elec. Co.	Marshalltown, Iowa	248
KFIO	North Central High School	Spokane, Wash.	252
KFJD	Weld County Printing & Pub. Co.,	Greeley, Colo.	236
KFKA	Colorado State Teachers College,	Greeley, Colo.	248
KFKH	Denver Park Amusement Co.	Lakeside, Colo.	226
KFLE	National Educational Service	Denver, Colo.	268
WBL	T. & H. Radio Co.	Anthony, Kansas	261
WBS	May & Co.	Newark, N. J.	360
WBT	Southern Radio Corporation	Charlotte, N. C.	360
WBU	City of Chicago	Chicago, Ill.	360
WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.	337
WCE	Findley Electric Co.	Minneapolis, Minn.	360
WCK	Stix-Baer-Fuller	St. Louis, Mo.	360
WCM	University of Texas	Austin, Texas	360
WCP	Classic University	Worcester, Mass.	360
WCX	Detroit Free Press	Detroit, Mich.	517
WDM	Church of the Covenant	Washington, D. C.	360
WDT	Ship Owners Radio Service, Inc., Premier Grand Piano Corporation	New York, N. Y.	405
WDZ	James L. Bush	Tuscola, Ill.	278
WEH	Benwood Co.	St. Louis, Mo.	360
WEV	Midland Refining Co.	Tulsa, Okla.	360
WEW	Hurlburt-Still Electrical Co.	Houston, Tex.	360
WFI	St. Louis University	St. Louis, Mo.	261
WFV	Strawbridge & Clothier	Philadelphia, Pa.	395
WFY	Coradio Co.	Wichita, Kans.	360
WGN	The Register & Tribune	Des Moines, Iowa	360
WGI	American Radio and Research Corporation,	Medford Hillside, Mass.	360
WGL	Thomas F. J. Howlett	Philadelphia, Pa.	360
WGM	Atlanta Constitution	Atlanta, Ga.	429
WGR	Federal Tel. & Tel. Co.	Buffalo, N. Y.	360
WGV	Interstate Electric Co.	New Orleans, La.	360
WGY	General Electric Co.	Schenectady, N. Y.	360
WHA	University of Wisconsin	Madison, Wisc.	360
WHB	Sweeney School Co.	Kansas City, Mo.	411
WHD	West Virginia University	Morgantown, W. Va.	360
WHK	The Radiovox Company	Cleveland, Ohio	360
WHN	Ridgewood Times Printing & Pub. Co.,	Ridgewood, N. Y.	360
WHX	Iowa Radio Corporation	Des Moines, Iowa	360
WIK	K. & L. Electric Co.	McKeesport, Pa.	360
WIL	Continental Electric Supply Co.	Washington, D. C.	360
WIP	Gimbel Bros.	Philadelphia, Pa.	509
WIZ	Cino Radio Mfg. Co.	Cincinnati, Ohio	360
WJD	Richard Harris Howe	Granville, Ohio	229
WJH	White & Boyer Co.	Washington, D. C.	273
WJK	Service Radio Equipment Co.	Toledo, Ohio	360
WJX	DeForest Radio Tel. & Tel. Co.	New York, N. Y.	360
WJY	Radio Corp. of America	Aeolian Hall, N. Y. C.	405
WJZ	Radio Corp. of America	Aeolian Hall, N. Y. C.	455
WKA	Landaus Music & Jewelry Co.	Wilkes-Barre, Pa.	360
WKC	Joseph M. Zamoiski Co.	Baltimore, Md.	360
WKN	Riechman-Crosby Co.	Memphis, Tenn.	360
WKY	Oklahoma Radio Shop	Oklahoma City, Okla.	360
WLB	University of Minnesota	Minneapolis, Minn.	360
WLH	Hamilton Mfg. Co.	Indianapolis, Ind.	360
WLW	Crosley Mfg. Co.	Cincinnati, Ohio	309
WMA	Arrow Radio Laboratories	Anderson, Ind.	360
WMC	Commercial	Memphis, Tenn.	500
WMH	Precision Equipment Co.	Cincinnati, Ohio	240
WMU	Doubleday-Hill Elec. Co.	Pittsburgh, Pa.	261
WNJ	Shotton Radio Mfg. Co.	Albany, N. Y.	400
WNO	Wireless Telephone Co. of Hudson County,	N. J. Jersey City, N. J.	360
WOC	Palmer School of Chiropractic	Davenport, Iowa	484
WOI	Iowa State College	Ames, Iowa	360
WOK	Arkansas Light & Power Co.	Pine Bluff, Iowa	360
WOO	John Wanamaker	Philadelphia, Pa.	509
WOQ	Western Radio Co.	Kansas City, Mo.	360
WOR	L. Bamberger Co.	Newark, N. J.	405
WOS	Missouri State Mktg. Bureau,	Jefferson City, Mo.	360
WOU	Metropolitan Utilities District	Omaha, Nebr.	360
WPA	Fort Worth Record	Fort Worth, Tex.	360
WPG	Nushawg Poultry Farm	New Lebanon, Ohio	360
WPI	Electric Supply Co.	Clearfield, Pa.	360
WPO	United Equipment Co.	Memphis, Tenn.	360
WQX	Walter A. Kushl	Chicago, Ill.	360
WRK	Doron Brothers Electric Co.	Hamilton, Ohio	360
WRL	Union College	Schenectady, N. Y.	360
WRM	University of Illinois	Urbana, Ill.	360
WRP	Federal Institute of Radio Telegraphy,	Camden, N. J.	360
WRR	City of Dallas (Police and Fire Signal Department),	Dallas, Tex.	360
WRW	Tarrytown Radio Research Lab.	Tarrytown, N. Y.	273
WSL	J. & M. Electric Co.	Utica, N. Y.	273
WSB	Atlanta Journal	Atlanta, Ga.	429
WSY	Alabama Power Co.	Birmingham, Ala.	360
WSZ	Marshall-Gerken Co.	Toledo, Ohio	360
WTG	Kansas State Agr. College	Manhattan, Kans.	360
WTP	George M. McBride	Bay City, Mich.	360
WWB	Daily News Printing Co.	Canton, Ohio	360
WWI	Ford Motor Co.	Dearborn, Mich.	273
WWJ	The Detroit News	Detroit, Mich.	517
WWL	Loyola University	New Orleans, La.	360
WWZ	John Wanamaker	New York, N. Y.	360
WAAB	Valdemar Jensen	New Orleans, La.	268
WAAC	Tulane University	New Orleans, La.	360
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers Journal	Chicago, Ill.	268
WAAH	Commonwealth Electric Co.	St. Paul, Minn.	360
WAAK	Gimbel Bros.	Milwaukee, Wis.	360
WAAL	Beamish Electric Co.	Minneapolis, Minn.	360
WAAM	L. E. Nelson Co.	Newark, N. J.	263
WAAN	University of Missouri	Columbia, Mo.	254
WAAP	Otto W. Taylor	Wichita, Kans.	360
WAAQ	New England Motor Sales Co.,	Greenwich, Conn.	360
WAAS	Georgia Radio Co.	Decatur, Ga.	360
WAAW	Omaha Grain Exchange	Omaha, Nebr.	360
WAAY	Yahring-Raynor Piano Co.	Youngstown, Ohio	360
WAAZ	Hollister-Miller Motor Co.	Emporia, Kans.	360
WABA	Lake Forest College	Lake Forest, Ill.	266
WABB	Dr. John B. Lawrence	Harrisburg, Pa.	268
WABC	Fulwider-Grimes Battery Co.	Anderson, Ind.	268
WABD	Parker High School	Dayton, Ohio	286
WABE	Y. M. C. A.	Washington, D. C.	283
WABF	Mt. Vernon Register-News Co.	Mt. Vernon, Ill.	234
WABG	Arnold Edwards Piano Co.	Jacksonville, Fla.	248
WABH	Lake Shore Tire Co.	Sandusky, Ohio	240
WABI	Bangor Railway and Elec. Co.	Bangor, Me.	240
WABJ	Radio Laboratories	South Bend, Ind.	240
WABK	First Baptist Church	Worcester, Mass.	252
WABL	Connecticut Agri. College	Storrs, Conn.	283
WABM	P. E. Doherty	Saginaw, Mich.	234
WABN	Waldo C. Grover	La Crosse, Wisc.	234
WABO	Lake Avenue Baptist Church	Rochester, N. Y.	233
WAJV	Indian Pipe Line Corp.	Princeton, Ind.	360
WBAA	Purdue University	West Lafayette, Ind.	360
WBAD	Sterling Electric Co. and Journal Printing Co.,	Minneapolis, Minn.	360
WBAH	The Dayton Co.	Minneapolis, Minn.	360
WBAN	Wireless Phone Corporation	Paterson, N. J.	286
WBAO	James Millikin University	Decatur, Ill.	244
WBAP	Wortham-Carter Pub. Co., The Star Telegram,	Ft. Worth, Tex.	360
WBAU	Republican Publishing Co.	Hamilton, Ohio	476
WBAV	Ermer & Hopkins Co.	Columbus, Ohio	239
WBAW	Marietta College	Marietta, Ohio	360
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	246
WBAY	Western Electric Co.	New York, N. Y.	360
WBBA	Newark Radio Laboratory	Newark, Ohio	492
WBBC	Sterling Radio Equipment Co.	Sterling, Ill.	240
WBBD	Barbey Battery Service	Reading, Pa.	229
WCAB	Newburgh News Printing & Publishing Co.,	Newburgh, N. Y.	360
WCAD	St. Lawrence University	Canton, N. Y.	360
WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.	461
WCAF	Michigan Limestone & Chemical Co.,	Rodgers, Mich.	360
WCAG	Clyde B. Randall	New Orleans, La.	268
WCAH	Entrekin Electric Co.	Columbus, Ohio	296
WCAJ	Nebraska Wesleyan University,	University Pl., Nebr.	360
WCAK	Alfred P. Daniel	Houston, Tex.	360
WCAL	St. Olaf College	Northfield, Minn.	336
WCAM	Villanova College	Villanova, Pa.	360
WCAO	Sanders & Stayman Co.	Baltimore, Md.	360
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.	360
WCAS	William Hood Dunwoody Industrial Institute	Minneapolis, Minn.	360
WCAT	South Dakota School of Mines	Rapid City, S. D.	240
WCAU	Durham & Co.	Philadelphia, Pa.	286
WCAV	J. C. Dice Electric Co.	Little Rock, Ark.	360
WCAX	University of Vermont	Burlington, Vt.	360
WCAY	Kesselman O'Driscoll Music House,	Milwaukee, Wisc.	281
WCBA	Charles W. Haimbach	Allentown, Pa.	286
WCBD	Wilbur Glenn Voliva	Zion, Ill.	345
WCBS	K & K Radio Supply Co.	Greenville, Ohio	240
WDAD	Central Kansas Radio Supply	Lindsborg, Kans.	360
WDAE	Tampa Daily Times	Tampa, Fla.	360
WDAF	Kansas City Star	Kansas City, Mo.	411
WDAG	Martin J. Laurence	Amarillo, Tex.	283
WDAH	Trinity Methodist Church	El Paso, Tex.	360
WDAI	Hughes Radio Corporation	Syracuse, N. Y.	246

WDAJ	Atlanta & West Point R. R. Co., College Park, Ga.	360
WDAK	Hartford Courant ..... Hartford, Conn.	261
WDAL	Florida Times Union ..... Jacksonville, Fla.	360
WDAM	Weston Electric Co. ..... New York, N. Y.	360
WDAO	Automotive Electric Co. ..... Dallas, Tex.	360
WDAP	Midwest Radio Central, Inc. ..... Chicago, Ill.	360
WDAR	Lit Brothers ..... Philadelphia, Pa.	395
WDAS	Samuel W. Waite ..... Worcester, Mass.	360
WDAU	Slocum & Kilburn ..... New Bedford, Mass.	360
WDAX	First National Bank ..... Centerville, Iowa	360
WDAY	Fargo Radio Service Co. ..... Fargo, N. D.	244
WDBC	Kirk Johnson & Co., Inc. ..... Lancaster, Pa.	258
WDBF	Robert G. Phillips ..... Youngstown, Ohio	261
WEAA	Fallain and Lathrop ..... Flint, Mich.	230
WEAB	Standard Radio Equipment Co. ..... Fort Dodge, Ia.	360
WEAD	Henry Radio & Elec. Supply ..... Atwood, Kans.	268
WEAE	Virginia Polytechnic Institute ..... Blacksburg, Va.	360
WEAF	American Tel. & Tel. ..... New York, N. Y.	492
WEAG	Nichols Hineline Bassett Laboratory, Edgewood, R. I.	231
WEAH	Wichita Board of Trade & Landers Radio Co., Winchita, Kans.	360
WEAI	Cornell University ..... Ithaca, N. Y.	266
WEAJ	University of South Dakota ..... Vermilion, S. D.	360
WEAK	Julius B. Abercombie ..... St. Joseph, Mo.	360
WEAM	North Plainfield, Borough of N. Plainfield, North Plainfield, N. J.	252
WEAN	Shepard Co. ..... Providence, R. I.	273
WEAO	Ohio State University ..... Columbus, Ohio	360
WEAP	Mobile Radio Co., Inc. ..... Mobile, Ala.	360
WEAR	Baltimore Am. & News Pub. Co., Baltimore, Md.	360
WEAS	Hecht Company ..... Washington, D. C.	360
WEAU	Davidson Brothers Co. ..... Sioux City, Iowa	360
WEAV	Sheridan Electric Service Co. ..... Brushville, Nebr.	360
WEAX	T. J. M. Daly ..... Little Rock, Ark.	360
WEAY	Will Horwitz, Jr. ..... Houston, Tex.	360
WEAZ	Donald Redmond ..... Waterloo, Iowa	360
WFAA	A. H. Belo & Co. ..... Dallas, Tex.	476
WFAB	Carl C. Woese ..... Syracuse, N. Y.	234
WFAC	Superior Radio Co ..... Superior, Mich.	360
WFAF	Henry C. Spratley ..... Poughkeepsie, N. Y.	273
WFAG	Radio Engineering Laboratory, Waterford, N. Y.	360
WFAH	Electrical Supply Co. ..... Port Arthur, Tex.	360
WFAJ	Hi-Grade Wireless Instrument Co., Asheville, N. C.	360
WFAM	Times Publishing Co. ..... St. Cloud, Minn.	360
WFAN	Hutchinson Elec. Service Co. ..Hutchinson, Minn.	360
WFAQ	Missouri Wesleyan College & Cameron Radio Co., Cameron, Mo.	360
WFAT	Daily Argus Leader ..... Sioux Falls, S. D.	360
WFAV	University of Nebraska ..... Lincoln, Nebr.	360
WFAZ	South Carolina Radio Shop ..... Charleston, S. C.	360
WGAC	Orpheum Radio Stores Co. ..... Brooklyn, N. Y.	360
WGAD	Spanish Am. Sch. of Telegraphy, Ensonada, P. R.	360
WGAJ	W. H. Glass ..... Shenandoah, Iowa	360
WGAL	Lancaster Elec. Supply & Const. Co., Lancaster, Pa.	248
WGAM	Orangeburg Radio Equipment Co., Orangeburg, S. C.	360
WGAN	Cecil E. Lloyd ..... Pensacola, Fla.	360
WGAQ	W. G. Patterson ..... Shreveport, La.	360
WGAR	Southern American ..... Fort Smith, Ga.	360
WGAU	Marcus G. Limb ..... Wooster, Ohio	226
WGAW	Ernest C. Albright ..... Altoona, Pa.	261
WGAX	Radio Electric Co., Washington Courthouse, Ohio	360
WGAY	North Western Radio Co. ..... Madison, Wisc.	360
WGAZ	South Bend Tribune ..... South Bend, Ind.	360
WHAA	State University of Iowa ..... Iowa City, Iowa	283
WHAB	Clark W. Thompson ..... Galveston, Tex.	360
WHAC	Cole Brothers Elec. Co. ..... Waterloo, Iowa	360
WHAD	Marquette University ..... Milwaukee, Wisc.	360
WHAE	Automotive Electric Service Co. ..Sioux City, Ia.	360
WHAG	University of Cincinnati ..... Cincinnati, Ohio	222
WHAH	J. T. Griffin ..... Joplin, Mo.	360
WHAK	Roberts Hardware Co. ..... Clarksburg, W. Va.	360
WHAL	Lansing Capital News ..... Lansing, Mich.	248
WHAM	School of Music, Rochester Univ., Rochester, N. Y.	360
WHAO	F. A. Hill ..... Savannah, Ga.	360
WHAP	Dewey L. Otta ..... Decatur, Ill.	360
WHAQ	Semmes Motor Co. ..... Washington, D. C.	242
WHAS	Courier Journal & Times ..... Louisville, Ky.	400
WHAV	Wilmington Elec. & Supply Co., Wilmington, Del.	360
WHAW	Pierce Electric Co. ..... Tampa, Fla.	360
WHAX	Huntington Press ..... Huntington, Ind.	360
WHAZ	Rensselaer Polytechnic Institute ..... Troy, N. Y.	380
WIAB	Joslyn Automobile Co. ..... Rockford, Ill.	360
WIAD	Ocean City Yacht Club ..... Ocean City, N. J.	254
WIAE	Mrs. Robt. E. Zimmerman ..... Venton, Ia.	360
WIAF	Gustav A. De Cortin ..... New Orleans, La.	234
WIAH	Continental Radio Mfg. Co. ..... Newton, Ia.	360
WIAI	Heers Stores Co. ..... Springfield, Mo.	360
WIAK	Journal Stockman Co. ..... Omaha, Nebr.	278
WIAP	J. A. Rudy & Sons ..... Paducah, Ky.	360
WIAQ	Chronicle Publishing Co. ..... Marion, Ind.	360
WIAS	Burlington Hawkeye-Home Elec. Co., Burlington, Ia.	361
WIAT	Leon T. Noel ..... Tarkio, Mo.	360
WIAU	American Sec. & Sav. Bank ..... Le Mars, Ia.	360
WIAV	New York Radio Laboratories, Binghamton, N. Y.	360
WIAW	Saginaw Radio & Elec. Co. ..... Saginaw, Mich.	360
WIAY	Fox River Valley Radio Supply Co., Neenah, Wisc.	224
WIAD	Jackson's Radio Eng. Lab. ..... Waco, Tex.	360
WIAF	Press Pub. Co. ..... Muncie, Ind.	360
WJAG	Huse Publishing Co. ..... Norfolk, Nebr.	360
WJAJ	Y. M. C. A. ..... Dayton, Ohio	360
WJAK	White Radio Laboratory ..... Stockdale, Ohio	360
WJAM	D. M. Ferham ..... Cedar Rapids, Ia.	360
WJAN	Peoria Star Co. ..... Peoria, Ill.	280
WJAP	Kelly-Duluth Co. ..... Duluth, Minn.	360
WJAR	The Outlet Co. ..... Providence, R. I.	360
WJAS	Capper Publications ..... Topeka, Kans.	360
WJAT	Kelley-Vawter Jewelry Co. ..... Marshall, Mo.	360
WJAX	Union Trust Co. ..... Cleveland, Ohio	390
WJAZ	Chicago Radio Laboratory ..... Chicago, Ill.	448
WKAA	H. F. Paar & Republican Times, Cedar Rapids, Ia.	360
WKAC	Star Publishing Co. ..... Lincoln, Nebr.	275
WKAF	W. S. Radio Supply Co. and Wm. Schack, Wichita Falls, Tex.	360
WKAH	Planet Radio Co. ..... West Palm Beach, Fla.	360
WKAK	Okfuskee County News ..... Okemah, Okla.	360
WKAL	Gray & Gray	360
WKAN	Alabama Radio Mfg. Co. ..... Montgomery, Ala.	360
WKAP	Dutee Wilcox Flint ..... Cranston, R. I.	360
WKAQ	Radio Corporation of Porto Rico, San Juan, P. R.	360
WKAR	Michigan Agri. College ..... East Lansing, Mich.	360
WKAS	L. E. Lines Music Co. ..... Springfield, Mo.	360
WKAV	Laconia Radio Club ..... Laconia, N. H.	360
WKAW	United Battery Service Co., Montgomery, Ala.	226
WKAX	W. A. Macfarlane ..... Bridgeport, Conn.	231
WKAY	Brenau College ..... Janesville, Ga.	360
WKAC	North Carolina State College ..... Raleigh, N. C.	360
WLAG	Cutting & Washington Radio Corp., Minneapolis, Minn.	417
WLAH	Samuel Woodworth ..... Syracuse, N. Y.	234
WLAJ	Waco Electrical Supply Co. ..... Waco, Tex.	360
WLAK	Vermont Farm Mach. Co. ..... Bellows Falls, Vt.	360
WLAL	Tulsa Radio Co. ..... Tulsa, Okla.	360
WLAN	Putnam Hardware Co. ..... Houlton, Me.	360
WLAP	W. Y. Jordon ..... Louisville, Ky.	360
WLAQ	A. E. Schilling ..... Kalamazoo, Mich.	360
WLAS	Central Radio Supply Co. ..... Hutchinson, Kans.	244
WLAT	Radio and Specialty Co. ..... Burlington, Iowa	360
WLAV	Electric Shop, Inc. ..... Pensacola, Fla.	360
WLAW	New York Police Dept. ..... New York, N. Y.	360
WLAX	Greencastle Community Broadcasting Station, Greencastle, Ind.	231
WLAY	Northern Commercial Co. of Alaska, Fairbanks, Alaska	360
WLAZ	Hutton & Jones Electric Co. ..... Warren, Ohio	248
WMAB	Radio Supply Co. ..... Oklahoma City, Okla.	360
WMAC	J. Edward Page ..... Cazenovia, N. Y.	261
WMAF	Round Hills Radio Corp. ..... Dartmouth, Mass.	360
WMAG	Tucker Electric Co. ..... Liberal, Kans.	360
WMAH	General Supply Co. ..... Lincoln, Nebr.	254
WMAJ	Drovers Telegram Co. ..... Kansas City, Mo.	275
WMAK	Norton Laboratories ..... Lockport, N. Y.	360
WMAL	Trenton Hdw. Co. ..... Trenton, N. J.	256
WMAM	Beaumont Radio Equipment Co. ..Beaumont, Tex.	360
WMAN	First Baptist Church ..... Columbus, Ohio	286
WMAP	Utility Battery Service, Inc. ..... Easton, Ohio	246
WMAQ	Chicago Daily News ..... Chicago, Ill.	448
WMAR	Waterloo Electrical Supply Co. ..... Waterloo, Iowa	360
WMAT	Paramount Radio Corporation ..... Duluth, Minn.	360
WMAV	Alabama Polytechnic Institute ..... Auburn, Ala.	250
WMAW	Wahpeton Elec. Co. ..... Wahpeton, N. D.	360
WMAX	K. & K. Radio Supply Co. ..... Ann Arbor, Mich.	360
WMAY	Kingshighway Presby. Church ..... St. Louis, Mo.	360
WMAZ	Mercer University ..... Macon, Ga.	268
WNAB	Park City Daily News ..... Bowling Green, Ky.	360
WNAC	Shepard Stores ..... Boston, Mass.	360
WNAD	Oklahoma Radio Eng. Co. ..... Norman, Okla.	360
WNAL	R. J. Rockwell ..... Omaha, Nebr.	360
WNAM	Elec. Apparatus Co. ..... Evansville, Ind.	360
WNAN	Syracuse Radio Telephone Co. ..... Syracuse, N. Y.	286
WNAP	Wittenberg College ..... Springfield, Ohio	360
WNAQ	Charleston Radio Elec. Co. ..... Charleston, S. C.	360
WNAR	C C. Rhodes ..... Butler, Mo.	360
WNAS	Texas Radio Corporation and Austin Statesman, Austin, Tex.	360
WNAT	Lenning Bros. Co. ..... Philadelphia, Pa.	360
WNAW	Henry Kunzmann ..... Fortress Monroe, Va.	360
WNAX	Dakota Radio Apparatus Co. ..... Yankton, S. D.	244
WNAY	Ship Owners' Radio Service ..... Baltimore, Md.	360
WOAA	Dr. Walter Hardy ..... Ardmore, Okla.	360
WOAB	Valley Radio ..... Grand Forks, N. D.	360
WOAC	Maus Radio Co. ..... Lima, Ohio	256
WOAD	Friday Battery & Elec. Co. ..... Sigourney, Iowa	360
WOAE	Midland College ..... Fremont, Nebr.	360
WOAF	Tyler Commercial College ..... Tyler, Tex.	360
WOAG	Apollo Theatre ..... Belvidere, Ill.	224
WOAH	Palmetto Radio Corp. ..... Charleston, S. C.	360
WOAI	Southern Equipment Co. ..... San Antonio, Texas	395
WOAJ	Ervin's Electrical Co. ..... Parsons, Kans.	360
WOAK	Collins Hardware Co. ..... Frankfort, Ky.	240
WOAL	Wm. E. Woods ..... Webster Groves, Mo.	360
WOAN	James D. Vaughan ..... Lawrenceburg, Tenn.	360
WOAP	Kalamazoo College ..... Kalamazoo, Mich.	360
WOAR	Henry P. Lundskow ..... Kenosha, Wisc.	360
WOAS	Bailey's Radio Shop ..... Middletown, Ohio	360
WOAT	Boyd Martell Hamp ..... Wilmington, Del.	360
WOAU	Snowder Boiling Piano Co. ..... Evansville, Ind.	360
WOAV	Pennsylvania National Guard	360
WOAW	Woodmen of the World ..... Erie, Pa.	360
WOAX	Franklyn J. Wolff ..... Omaha, Nebr.	360
WOAZ	Penick Hughes Co. ..... Trenton, N. J.	360
WPAB	Pennsylvania State College ..... Stanford, Tex.	360
WPAC	Donaldson Radio Co. ..... State College, Pa.	360
WPAD	Wieboldt & Co. ..... Okmulgee, Okla.	360
WPAF	Peterson's Radio Co. ..... Chicago, Ill.	360
WPAG	Central Radio Co., Inc. ..... Council Bluffs, Iowa	360
WPAH	Wisconsin Dept. of Markets ..... Independence, Mo.	360
WPAJ	Doolittle Radio Corporation ..... Waupaca, Wisc.	360
WPAK	No. Dakota Agricultural College ..... New Haven, Conn.	360
WPAL	Superior Radio & Telephone Co., Fargo, N. D.	360
WPAM	Awerbach & Guettel ..... Columbus, Ohio	360
WPAP	Theodore D. Phillips ..... Topeka, Kans.	360
WPAQ	General Sales & Eng. Co. ..... Winchester, Ky.	360
WPAR	R. A. Ward ..... Frostburg, Md.	360
WPAS	J. & M. Electric Co. ..... Beloit, Kans.	360
WPAT	St. Patrick's Cathedral ..... Amsterdam, N. Y.	360
WPAU	Concordia College ..... El Paso, Tex.	360
WPAY	Bangor Radio Laboratory ..... Moorhead, Minn.	360
WPAZ	John R. Koch ..... Bangor, Me.	360
WQAA	Horace A. Beale, Jr. ..... Charleston, West Va.	273
WQAB	Southwest Missouri State Teachers College, Parkersburg, Pa.	360
WQAC	E. B. Gish ..... Springfield, Mo.	278
WQAD	Whitehall Electric Co. ..... Amarille, Tex.	360
WQAE	Moore Radio News Station ..... Waterbury, Conn.	242
WQAF	Sandusky Register ..... Springfield, Vt.	360
WQAH	Brock Anderson Elec. Eng. Co. ..Sandusky, Ohio	240
WQAK	Appel-Higley Electric Co. ..... Lexington, Ky.	254
WQAL	Cole County Tel. & Tel. Co. ..... Mattoon, Ill.	360
WQAM	Electrical Equipment Co. ..... Miami, Fla.	360
WQAN	Scranton Times ..... Scranton, Pa.	360
WQAO	Calvary Baptist Church ..... New York, N. Y.	360
WQAQ	West Texas Radio Co. ..... Abilene, Tex.	360
WQAS	Prince Walter Co. ..... Lowell, Mass.	360
WQAT	Radio Equipment Corporation ..Westhampton, Va.	360
WQAV	Huntington and Guerry, Inc. ..... Greenville, S. C.	360
WQAW	Catholic University of America, Washington, D. C.	360
WQAX	Radio Equipment Co. ..... Peoria, Ill.	360
WQAY	Gaston Music & Furniture Co. ..Hastings, Nebr.	360
WQAZ	Greensboro Daily News ..... Greensboro, N. C.	360
WRAA	Rice Institute ..... Houston, Tex	360
WRAB	Savannah Board of Public Education, Savannah, Ga.	360
WRAC	State Normal School ..... Maryville, N. D.	360
WRAD	Taylor Radio Shop ..... Marion, Kans.	360
WRAF	Radio Club, Inc. ..... Laporte, Ind.	224
WRAH	Stanley N. Read ..... Providence, R. I.	360
WRAK	Economy Light Co. ..... Escanaba, Mich.	360
WRAL	Northern States Power Co. ..St. Croix Falls, Wisc.	346
WRAM	Lombard College ..... Galesburg, Ill.	360
WRAN	Black Hawk Electrical Co. ..... Waterloo, Iowa	220
WRAO	Radio Service Co. ..... St. Louis, Mo.	360
WRAP	Winter Park Elec. Construction Co., Winter Park, Fla.	360
WRAR	Jacob C. Thomas ..... David City, Nebr.	220
WRAS	Radio Supply Co. ..... McLeansboro, Ill.	360
WRAU	Amarillo Daily News ..... Amarillo, Tex.	360
WRAV	Antioch College ..... Yellow Spring, Ohio	360
WRAW	Horace D. Good ..... Reading, Pa.	220
WRAX	Flexon's Garage ..... Gloucester City, N. J.	220
WRAY	Radio Sales Corporation ..... Scranton, Pa.	360
WRAZ	Rensselaer Polytechnic Institute ..... Troy, N. Y.	360
WSAA	B. S. Sprague Elec. Co. ..... Marietta, Ohio	360
WSAB	Southeast Mo. State College, Cape Girardeau, Mo.	360
WSAC	Clemson Agri. College ..... Clemson College, S. C.	360
WSAD	J. A. Foster Co. ..... Providence, R. I.	361
WSAH	A. G. Leonard, Jr. ..... Chicago, Ill.	360
WSAI	U. S. Playing Card Co. ..... Cincinnati, Ohio	360
WSAJ	Grove City College ..... Grove City, Pa.	360
WSAL	Franklin Electrical Co. ..... Brookville, Ind.	360
WSAP	Seventh Day Adventist Church ..New York, N. Y.	263
WSAT	Plainview Electric Co. ..... Plainview, Tex.	360
WSAV	Clifford W. Vick, Radio Construction Co., Houston, Tex.	360
WTAC	Penn Traffic Co. ..... Johnstown, Pa.	360
WTAG	Kern Music Co. ..... Providence, R. I.	258
WTAK	Swan-Bower Co. ..... Steubenville, Ohio	286
WTAS	Charles E. Erbstein ..... Elgin, Ill.	275
WTAU	Ruegy Battery & Elec. Co. ..... Tecumseh, Nebr.	360
WTAW	Agriculture and Mech. College, College Station, Tex.	234
WWAC	Sanger Brothers ..... Waco, Tex.	360
WWAD	Wright & Wright, Inc. ..... Philadelphia, Pa.	360
WWAH	General Supply Co. ..... Lincoln, Nebr.	360
WWAX	Worman Brothers ..... Laredo, Tex.	360
WWAY	Marigold Gardens ..... Chicago, Ill.	360

Canadian Broadcasting Stations

CFAC	Radio Corporation of Calgary, Ltd.	Calgary, Alberta
CFCA	Star Publishing and Printing Co.	Toronto, Ontario
CFCB	Marconi Wireless Telegraph Co. of Canada, Ltd.	Vancouver, B. C.
CFCD	Canadian Westinghouse Co., Ltd.	Winnipeg, Manitoba
CFCE	Marconi Wireless Telegraph Co. of Canada,	Halifax, Nova Scotia
CFCF	Marconi Wireless Telegraph Co. of Canada, Ltd.,	Montreal, Quebec
CFCH	Abitibi Power and Paper Co., Ltd.,	Iroquois Falls, Ontario
CFCI	Motor Products Corporation	Walkerville, Ontario
CFCN	W. W. Grant Radio, Ltd.	Calgary, Alberta
CFCX	The London Advertiser	London, Ontario
CFPC	International Radio Development Co.,	Fort Frances, Ontario
CFTC	The Bell Telephone Co. of Canada	Toronto, Ontario
CFUC	University of Montreal	Montreal, Quebec
CFVC	Roy Russell Brown	Courtenay, British Columbia
CFYC	Victor Wentworth Odlum	Vancouver, B. C.
CFZC	Canadian Westinghouse Co., Ltd.	Montreal, Quebec
CHAC	Radio Engineers, Ltd.	Halifax, Nova Scotia
CHBC	The Albertan Publishing Co.	Calgary, Alberta
CHCA	Radio Corporation of Vancouver, Ltd.,	Vancouver, B. C.
CHCB	Marconi Wireless Telegraph Co. of Canada, Ltd.,	Toronto, Ontario
CHCC	Canadian Westinghouse Co., Ltd.,	Edmonton, Alberta
CHCF	Radio Corporation of Winnipeg, Ltd.,	Winnipeg, Manitoba
CHCQ	The Western Radio Co., Ltd.	Calgary, Alberta
CHCS	London Radio Shoppe	London, Ontario
CHCX	R. L. Silver	Montreal, Quebec
CHCZ	The Globe Printing Co.	Toronto, Ontario
CHFC	John Millen & Sons, Ltd.	Toronto, Ontario
CHIC	Canadian Westinghouse Co., Ltd.,	Hamilton, Ontario
CHOC	Canadian Westinghouse Co., Ltd.	Vancouver, B. C.
CHVC	Metropolitan Motors, Ltd.	Toronto, Ontario
CHXC	J. R. Booth, Jr.	Ottawa, Ontario
CHYC	Northern Electric Co.	Montreal, Quebec
CJBC	Dupuis Freres	Montreal, Quebec
CJCA	The Edmonton Journal, Ltd.	Edmonton, Alberta
CJCB	James Gordon Bennett	Nelson, British Columbia
CJCD	T. Eaton Co., Ltd.	Toronto, Ontario
CJCE	Vancouver Sun Radiotelephones, Ltd.	Vancouver, B. C.
CJCF	News Record, Ltd.	Kitchener, Ontario
CJCG	Manitoba Free Press Co., Ltd.	Winnipeg, Manitoba
CJCH	The United Farmers of Ontario	Toronto, Ontario
CJCI	McLean, Holt & Co., Ltd.	St. John, New Brunswick
CJCN	Simons Agnew & Co.	Toronto, Ontario
CJCS	Eastern Telephone and Telegraph Co., Ltd.,	Halifax, Nova Scotia
CJCY	Edmund Taylor	Calgary, Alberta
CJGC	London Free Press Printing Co., Ltd.	London, Ontario
CJNC	Tribune Newspaper Co., Ltd.	Winnipeg, Manitoba
CJSC	The Evening Telegram	Toronto, Ontario
CKAC	La Presse Publishing Co.	Montreal, Quebec
CKCB	T. Eaton Co., Ltd.	Winnipeg, Manitoba
CKCD	Vancouver Daily Provinces	Vancouver, B. C.
CKCE	Canadian Independent Telephone Co., Ltd.,	Toronto, Ontario
CKCK	Leader Publishing Co., Ltd., of Regina,	Regina, Saskatchewan
CKCR	Jones Electric Radio Co., St. John, New Brunswick	
CKCS	The Bell Telephone Co. of Canada	Montreal, Quebec
CKCZ	Canadian Westinghouse Co., Ltd.	Toronto, Ontario
CKKC	Radio Equipment and Supply Co.	Toronto, Ontario
CKOC	The Wentworth Radio Supply Co.	Hamilton, Ontario
CKQC	Radio Supply Co. of London	London, Ontario
CKZC	Salton Radio Engineering Co.	Winnipeg, Manitoba

WORLD WIDE WIRELESS

Marconi Reveals Further Advances in Directional Radio

GUGLIELMO MARCONI recently revealed what he considers his greatest discovery of the last twenty years.

He said following his return to London from a trip on his yacht *Elettra*, that he had discovered hitherto unknown ether waves whereby wireless would be able to operate over a range heretofore unimagined at five times the previous speed and at a fractional expenditure of electric energy.

"The yacht *Elettra* operated at a distance of 2,400 miles from the Cape Verde Islands," Marconi said. "We used power less than had previously been used to send messages between London and Paris. Our results were practically perfect.

"It marks the revolution of wireless and brings the cost of operating by long distance stations down to a point of which we had previously not even dreamed, and will cheapen the cost of wireless to press and public to a most unexpected degree."

KPH Shows Its Mettle

A NEW long distance ship-to-shore record has been hung up by KPH, the Radio Corporation of America transmitter at Bolinas, Cal., and the S. S. *Tahiti*. On June 8, when the ship was about 5,900 miles distant, near Australia, traffic was still being exchanged as successfully as on the day the vessel sailed from San Francisco. The spark set at KPH was used for this work, and the fact that the signals had to go through the summer conditions of the northern hemisphere and the winter weather of the southern half of the globe makes the performance still more remarkable.

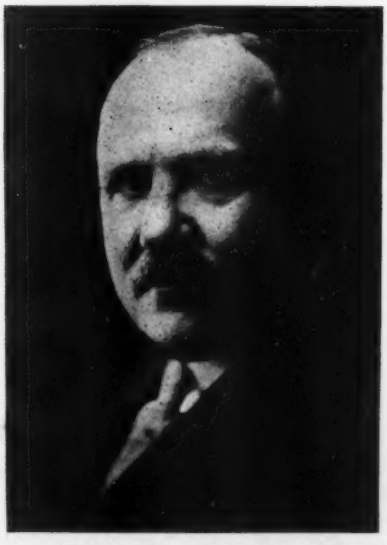
Navy Silencing "Mush"

RECENT reports from the U. S. Navy Department indicate a very considerable amount of interference from mush and harmonics at all points within 200 miles of Pearl Harbor in the Pacific. Current transformer circuits will be installed on the Honolulu transmitters of the Navy in the near future, which will eliminate this interference, it is hoped.

Naval experts admit that arc and spark transmitters create a considerable amount of interference in their vicinity, unless special circuits are installed to reduce such interference. Transmitters of these types are being modified as rapidly as funds permit. On arc transmitters current transformer or similar circuits are being installed and spark transmitters are being replaced by tube sets. Owing to the large number of transmitters operated by the Navy and the limited funds available, this work is, of necessity, proceeding slowly, but it is expected that the greater part of this interference will be eliminated during the next fiscal year.

Radio for Fireboats

BOSTON, Mass., is installing radio apparatus on three fireboats. These patrol the waterfront as far as Neponsit, and keep in touch with land by means of a signal light in a tower on a Boston wharf. In a fog or storm, however, this light is invisible at any distance. Consequently the sum of $7,000 has been set aside by the fire commissioner for the installation of a transmitting set at fire headquarters and receiving sets on the fireboats so that they will be in continuous touch with the authorities on shore. Philadelphia and Baltimore have similar installations.



The Honorable Ernest Lapointe, Canadian Minister of Radio. He was formerly Minister of Marine and Fisheries. In his new post he is studying not only commercial radio in Canada and its waters, but also the Canadian broadcasting problems

Successful Test of Secret Radio Telephony

THE American Telephone and Telegraph Company recently announced that a system of secret radio telephony had been given a long trial between Los Angeles, Calif., and Catalina Island, thirty miles off the coast. Side tone frequencies are used in this system to render speech unintelligible to anyone not equipped with the comprehensive and complicated receiving equipment necessary to "unscramble" them. It was announced that the secret system of radio telephony had given entire satisfaction not only for local conversations between the island and mainland, but also in the case of two-way conversations between the island and points inland, the transfer of the speech between radio and land lines being made at Los Angeles.

Air Express Guided by Wireless Compass

A DAIMLER air express, flying from Manchester to London, recently, was lost in the low clouds and mist which covered London and district, and was guided into the London Air Station by wireless telephone. The pilot was unable to locate his position and "rang up" the London Air Station on his wireless telephone. The wireless operators immediately set their direction-finding apparatus to work and discovered that the air express was several miles east of the aerodrome and wirelessed to the pilot the compass direction in which he should fly to bring him over the aerodrome, with the result that ten minutes later, heralded by the roar of its engines, the big red Daimler express loomed out of the mist and alighted 56 minutes late, but safe.

Treats Pneumonia by Radio

THE American liner *Manchuria*, when it arrived in New York recently, brought as a patient of Dr. E. H. Earle, the ship's surgeon, a fireman of the little American freighter *Charles Bartlow*, transferred at sea after the doctor had treated him by wireless for pneumonia. He was very ill and when the *Manchuria* got to Quarantine he was removed in the Health Officer's boat and sent to the Marine Hospital on Staten Island.

London Fish Expert Pleads for Radio Fish News

THE Marine Department of Canada at Ottawa announces the installation of broadcasting apparatus off the eastern shores of Canada with the object of keeping the fishing community at sea acquainted with the movement of the vast mackerel shoals so that the trawlers can be in the right place at the right moment and thus reap a richer harvest than might be the case through individual scouring of the deep. Messages will also be transmitted to fishermen on shore advising them of the approach of fish in migration.

"Read side by side with the rather parlous reports of the condition of the British fishing industry," comments a London marine biologist, "it would seem that here is a field into which radio broadcasting ought to enter without delay, thus assisting in a most welcome fashion one of this country's essential industries." The expert wants fish news broadcast by radio.

Fish migrate in countless millions, notably the herring, making their way down the East Coast of Britain from the colder seas north of Scotland. They come seeking the marine foods found more plentifully as a southern course is steered. In March and April they are off the shores of the Shetlands and Caithness, and a little later Fraserburgh fishermen reap the harvest. As the summer advances it is the turn of the Yorkshire and then the Norfolk fishing ports.

All these things are known in a limited zone, but there are tens of thousands of square miles of uncharted North Sea waters that must be the scene of similar travelings by other fish. Cod, for example, move down from Icelandic waters, while plaice are known to make periodical movements off the coast of Denmark. Individual rivalry of big trawling companies results in secrecy, but just as the British farmer must inevitably turn to more co-operative methods, so must the farmer of the seas, and, by a distribution of radio messages, broadcast from new stations, or from the existing marine laboratories, it should be possible to increase enormously the catches and, with better methods of distribution, to lower the cost to the consumer.

The secret of successful trawling is to be quickest at the spot where fish are densest, and it will readily be seen that wireless guidance would result in the saving of immense quantities of fuel now used in merely scouring the seas. Fish are most plentiful above those portions of the sea-bed which contain "plankton," their food.

With nets full, the next thing is to steam back as quickly as possible to the home port to discharge the cargoes, and broadcast messages could be sent from the trawlers themselves to the effect that the catch represents such and such a tonnage.

At present buyers and salesmen, waiting on the quay the arrival of the fishing fleet, are entirely in the dark as to the extent of the catch, hence those wild fluctuations of prices, and sometimes even casting back into the sea of tons of fish, which make angry the inland consumer.

"A triangle of North Sea broadcasting stations should be established," thinks the marine biologist, "impinging upon the Shetland Isles, Bergen or Heligoland, Denmark, Dover, Yarmouth, Hull and the Forth, controlling the fishing fleets of the North Sea."

Radio in Czecho-Slovakia

THE manufacture, sale, storage, and importation of radio telephone and telegraph equipment in Czecho-Slovakia is only permitted under license from the State, says Trade Commissioner H. L. Groves in a report to the U. S. Department of Commerce. The Ministry of Commerce, in co-operation with the Ministry of Posts and Telegraphs, are authorized to grant licenses for this purpose. The Ministry of Posts and Telegraphs also supervises and controls the manufacture, sale and storage of radio equipment and co-operates with the Ministry of Commerce in the granting of licenses.

Up to the present time only one company—"Radioslavia"—has obtained a license for the manufacture of radio equipment in Czecho-Slovakia. It has not yet started production. This company is understood to be affiliated or closely connected with the French Company "Societe Française Radio-électrique." A German company—"Gesellschaft für Drahtlöse Telegraphie, System Telefunken"—is said to be promoting a company with Czecho-Slovak capital for the purpose of exploiting German wireless patents, but it has not yet been granted the necessary license.

Now becoming a familiar sight in Parisian cafés—patrons put a nickel—cinq sous—in the box to hear radio concerts. The box and its telephone are connected with a central receiver

The attitude of the Ministry of Posts and Telegraphs toward the granting of licenses to transmit as well as to receive radio messages is said to be favorable in the following instances: (1) Technical high schools, for scientific purposes. (2) Industrial establishments which have obtained special licenses from the Ministry of Commerce to manufacture radio equipment. (3) Ships and aircraft. (4) Electric power stations, waterworks, and other establishments of public utility, under special conditions. (5) Companies which have been authorized by the State to broadcast matter of general interest, such as news statements, exchange reports, agricultural reports, concerts, lectures, etc.

Licenses for the operation of receiving sets only will be granted to institutions, companies, and those regularly taking the reports transmitted either by the State Telegraph Office or by companies authorized by the State to transmit such messages.

Naval Airships Will Have Radio Compasses

PLANS for equipping the two new naval rigid airships with radio compasses so that they can navigate in darkness or in fog are under consideration. These are the great ZR ships now building.

It is believed that the radio compass installations can be made satisfactorily, and that this feature will prove a valuable asset for the efficiency and safety of both personnel and material through assisting the accuracy of navigation. The location selected was adjacent to the observation platform located on top of the ship, well forward. A coil has been designed which will enable observations to be made in frequencies extending over a band of from approximately 600 to 16 kilocycles. If this installation is made satisfactorily it will be the first time a radio compass has been successfully installed upon a lighter-than-air craft.

Gen. Harbord's Picture Hung

THE portrait of Major General Harbord, painted on the order of the U. S. Marine Corps, was presented to the Army and Navy Club, Washington, D. C., on May 7. This is regarded in military circles as a most unusual tribute, it being very seldom that the Marines go outside their own Corps to honor a regular army officer.

Radio in Czecho-Slovakia

Temporary Transmitter Already Put in Operation at Podebrady—Remarkable Ground System of New Central European Station

Translated from Radioélectricité

IT is now more than a year since, on March 3, 1922, on the occasion of a Franco Czecho-Slovakia Radio Congress, Mr. Strnad, chief counsellor of the Czecho-Slovakian Ministry of Telegraphy, speaking in the City Hall at Prague, proposed a national radio central, which should be capable of connecting Czecho-Slovakia directly with all the other nations in Europe. Since then, work has been started, and the enterprise has been pushed with such speed that recently the smallest of the several transmitting stations has been opened for public service.

The Czecho-Slovakia Radio Central is situated 48 kilometers (28.8) miles to the east of Prague, near Podebrady, which is a Summer resort and watering place on the shore of the River Elbe. The location, therefore, is in the proximity of the capital, in the center of that region known to geographers as the Bohemian quadrilateral. Though separated from the bordering countries by means of uninterrupted mountain chains, this country has at its center a depression or level valley through which the Elbe meanders. The radio station has been constructed in the heart of that plain, along the line of the railroad from Prague to Breslau, from which can be seen the towers which support the antenna.

The essential reason, outside of proximity to the capital, which led to this choice of location, was the necessity for obtaining a good ground for the transmitting station. The stony and rocky ground generally found elsewhere was unsuitable, and only the plain of the Elbe offered suitable conditions. The ground that was chosen is particularly favorable and meets perfectly the technical requirements. Flooded in part by the Elbe in its annual Spring rise, the river's bed being insufficiently deep, the soil is damp during the greater part of the year. These conditions result in an ideal ground for the transmitter, guaranteeing satisfactory efficiency. The construction of this radio central began in August, 1922, following the preparatory work on the field. Wetness of the soil and the menace of floods made it impossible to place the structures directly on the ground in the usual manner. It was decided to make use of a reinforced concrete foundation for the buildings and for the towers.

The ground system, which may be seen in one of the pictures reproduced herewith, is particularly interesting. It utilizes 9,000 meters (29,700 ft.) of copper wire buried in the ground to a depth of 40 cm. (15½"), and takes the form of a fan spreading around the station. The antenna is supported by two metal masts 150 meters (495 ft.) high. These masts are square and of the same dimensions throughout, and are separated about 200 meters (666 ft.). The antenna is stretched laterally by means of two rows of twelve reinforced concrete masts 18 meters (59 ft.) high, on each side of the line between the two main towers at the extremity of the ground network.

The station, which has just been opened for public service, consists solely of a tube transmitter rated at 5 kw., and has been installed in a temporary building awaiting the completion of the permanent construction.

The continental station, which will be completed during the course of a year, will have two high frequency alternators rated at 50 kw. each, built in France, and similar to the machines now in use at French Radio Central at St Asisse. The two alternators will be capable of operating in parallel, or will be able to work simultaneously on two different wave lengths, the antenna being especially designed to permit of this. The radio central is connected with Prague by means of special telegraph lines and by means of suitable relays. Transmission will be effected directly from the central office at the capital.

This system will not only give Czecho-Slovakia direct communication with Great Britain, Scandinavia, Eastern Europe, the Balkans, Italy, Spain and France but it will also have sufficient range to permit direct communication with North Africa and Syria. In addition, of course, messages will be relayed to all parts of the world through the French station at St. Asisse and other high-power transmitters.

Local Radio in Denmark

RADIO telephone connection between Copenhagen and the island of Bornholm in the Baltic Sea, heretofore poorly equipped with means of communication, is now an accomplished fact, U. S. Trade Commissioner Sorensen reports. Radio telephony between the two points is now open to the public. The radio circuit consists of the four stations at Amager, Lyngby, Hammeren and Ronne. The installation permits of duplex operation. The ordinary Copenhagen telephone system is used.

Podebrady Radio Central, showing the two towers and two of the side masts

Looking from the top of one of the Podebrady towers over the ground system

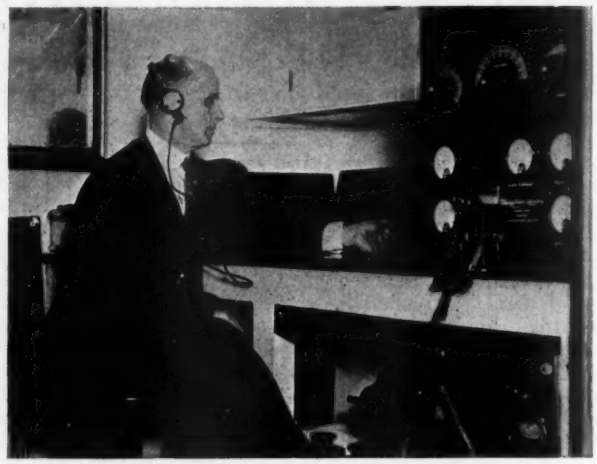
Radio in Arctic With Explorer MacMillan

THE 115-ton auxiliary schooner *Bowdoin*, bearing Capt. Donald B. MacMillan and his party on their way to resume scientific work and explorations in the Arctic, sailed from Wiscasset, Me., on June 23 on the first leg of its journey.

The party includes three who were on MacMillan's previous trip. These are Ralph P. Robinson of Merrimac, Mass., chief assistant; Thomas J. McCue of Brigus, Newfoundland, mate, and Richard Goddard of Winthrop, Mass., sent by the Carnegie Institute to continue the observations in terrestrial magnetism and atmospheric electricity, which he began in Baffin's Land.

The others are Donald H. Mix of Bristol, Conn., an expert radio operator; W. F. Lewis of East Lynn, Mass., cook, and John Jaynes of Somerville, Mass., an expert engineer.

Abraham Broomfield, an expert driver of Eskimo dogs, will be picked up at Jack Lanes Bay, near Davis Inlet, Labrador, for his second trip on the schooner.



Dr. Donald MacMillan listening in on the radio equipment installed aboard the "Bowdoin" with the idea of maintaining communication with the United States while the ship is in the Far North

Donald B. MacMillan, Dr. Sc., F. R. G. S., who was formerly a professor at Bowdoin College, and was first induced to go to the Arctic by Peary and incidentally accompanied Peary on the expedition on which Peary reached the Pole, has been back to the Arctic seven times since.

During a talk at a dinner given in his honor at Chicago recently, Dr. MacMillan told of the hardships of the Arctic. He said that the greatest hardship is not, as is commonly supposed, the intense cold which sends the mercury sometimes as low as 60 degrees below zero; that it is not the privations (for on one expedition which Captain MacMillan commanded he demonstrated that he and his crew could live for a year on nothing but the food which sustains the Eskimo), but that the greatest hardship is the awful solitude—everything going out and nothing coming in.

Dr. MacMillan was asked why he did not take along a radio set. Dr. MacMillan replied that it would take up too much space. There developed a considerable discussion of just what radio would do, in which discussion Dr. MacMillan became greatly interested. As an outcome, he arranged to install both sending and receiving sets aboard his ship, the *Bowdoin*, and converted the entire forward end of the forecastle into a radio room.

MacMillan has with him, installed in the fore part of the ship, a long-distance standard broadcast receiving set, with a wave length range of from 150 to 900 meters, and equipped with three-stage amplifier and loud speaking apparatus, as well as a long-wave receiving set with a maximum wave length of 20,000 meters. With these two sets reception will be possible of not only amateur telegraph and phone stations and radiophone broadcasting stations, but also naval and commercial trans-oceanic stations from which press reports, time signals, weather forecasts, etc., can be secured.

The transmitting equipment consists of a 500-cycle interrupted-continuous-wave set, using two 250-watt transmitter tubes. This apparatus is mounted very compactly in semi-panel form with all necessary meters, and is supplied with current by two gas-engine-driven Delco generator units entirely separate from the regular power plant of the ship.

The ship's antenna is of peculiar construction, due to the fact that the *Bowdoin* depends for part of its motive power on sails and is of comparatively short length. A stem to stern antenna is used, passing over the mainmast and foremast, the lead-in dropping through the fore deck to the radio quarters. In order to insure good ground, steel and copper plates have been riveted to the hull.

Dr. MacMillan has taken with him as wireless operator Donald H. Mix of Bristol, Conn. Mix was selected by Captain MacMillan from five men who were chosen by the American Radio Relay League.

Realizing the tremendous interest which the use of radio on an expedition of this character would arouse in the public mind, the League sent out a request for volunteers to all its members. Hundreds responded. Not only technical ability as an operator and the ability to withstand hardships were requisites, but in particular the faculty for making oneself congenial among a small crew of men on an ice-bound ship. Dr. MacMillan's crew consists of only seven men. Mix represents Captain MacMillan's choice from among some of the best wireless operators in the country.

Once a week Mix will transmit from the *Bowdoin* a five hundred-word story of Arctic adventure and will transmit also diagrams of all new lands and harbors and lands found and charted. At such times as has been arranged for Mix to attempt to get his wireless messages through all amateurs who are members of the League will stand by and tune in for Station WNP. The sending station on the *Bowdoin* has been assigned by the Government the call letters WNP, "Wireless North Pole." The Government has assigned wave lengths of 200, 300 and 400 meters and has also given permission for Station WNP to use whatever wave length it may find necessary for experimental purposes.

The American Broadcasting Station which will endeavor to send messages to Dr. MacMillan is the new Edgewater Beach Hotel Broadcasting Station, WJAZ, which incidentally is the most powerful broadcasting station in the country, having 4,000 volts and 10-kilowatt output. This station will not only be used to give Dr. MacMillan and his crew of seven entertainment and news of the day, but it will also be used by the families of Dr. MacMillan and his crew when they desire to send messages to those aboard the *Bowdoin* in the frozen north.

There is a period of 141 days in the Arctic during which a message sent at midnight must pass through hundreds of miles of sunlight before it reaches darkness. It will be interesting to see what effect these peculiar conditions of the Arctic have on radio communication. Up to the present time it has been thought that the so-called auroral band would act as a powerful deterrent in transmitting radio messages. At all events, there is no record of a message ever having been transmitted from the north through it. It will be interesting to learn to what extent the auroral band will interfere, and it is quite possible that scientific data of great importance will be gathered about the Aurora Borealis, which has always been a mystery.

Dr. MacMillan on his expedition primarily intends to study terrestrial magnetism. He will also co-operate with the Weather Bureau and Professor V. B. Ekerold, the distinguished Norwegian meteorologist who helped establish the wireless weather station at Jan Mayen Island off the coast of Greenland. Dr. MacMillan is also conducting some investigations for the Carnegie Institute of Washington.

Transmission by the *Bowdoin* will be on wavelengths of 185, 220 and 300 meters. Donald H. Mix, the radio operator, will stand by from 10 P. M. to midnight for press reports from Arlington; at midnight for reports from NSS; from 1 A. M. to 2:50 A. M. he will if possible, communicate with amateurs; 3 A. M. to 4:59 A. M. he will attempt to work stations operating under a limited commercial license, and from 5 A. M. to 7 A. M. again amateurs.

Amateur operators everywhere are greatly interested in the prospects of working through the Aurora Borealis. Never before, probably, have so many amateurs of the country focused their receiving sets upon a single isolated station in the frozen north. It will be interesting to learn what portions of the country receive these messages clearly.

On several nights since the *Bowdoin* left port on her way north her radio signals have been heard at amateur stations in New England and dispatches have been received at the station of Irving Vermilya, Marion, Mass., telling of the progress made on the first lap of the fourteen-month journey in the far north.

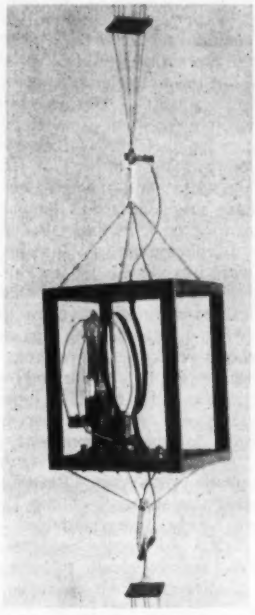
Directive Radio Transmission on a Wave-length of 10 Meters

By S. R. Winters

WHEN Guglielmo Marconi stated some months ago before the Institute of Radio Engineers that he had been conducting experiments in directive radio telegraphy in which wave-lengths as low as one meter were employed the announcement created great interest throughout the radio industry. More recently, however, the Radio Laboratory of the Bureau of Standards, United States Department of Commerce, has demonstrated in practice the feasibility of using a 10-meter wave-length in the transmission and reception of both radio-telephone and radio-telegraph messages. These, too, were of a directional character.

When F. W. Dunmore, and F. H. Engel, the radio engineers conducting these experiments for the Bureau of Standards, were installing equipment for these novel tests, this writer happened to pass the laboratory grounds. The network of wires formed such a mat on the ground that it appeared difficult for even an elusive grasshopper to light thereon without becoming enmeshed. The completed reflecting system, one of the ways of guiding electric waves along a specified direction, bears a similarity to the arrangement which the fisherman terms a "trot-line," a method whereby many short lines with hooks attached, when spaced at short intervals, may be cast into the waters and held in suspension by a single horizontal line that may span an entire stream and fastened on both banks of a river.

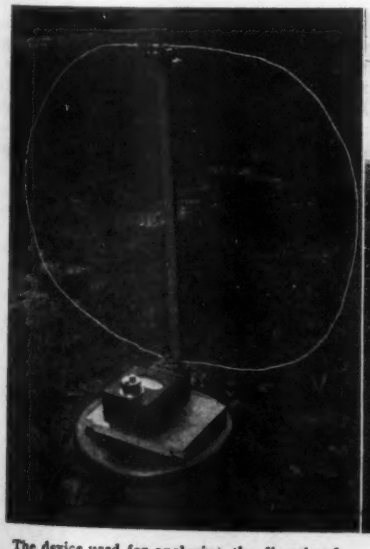
The method of transmitting extremely short wave-lengths, in this instance, took the formation of what the Radio Laboratory of the Bureau of Standards describes as a segment of a parabolic cylinder. Forty wires, spaced one foot apart, were suspended from a frame fashioned in the form of a parabola. Each of these abbreviated wires, insulated from the supporting frame as well as from each other, was in resonance with a frequency of ten meters or 30,000 kilocycles. The frame was suspended from a rope stretched between two poles, thereby enabling the reflection to be rotated through 360 degrees. A frame of this form is desirable as a means of obtaining the proper phase relations and the greatest amount of reflection. Having made the focal distance of the network of wires one-quarter of a wave-length—that is, 8 feet 2.4 inches—the parabolic frame was ready to be constructed.



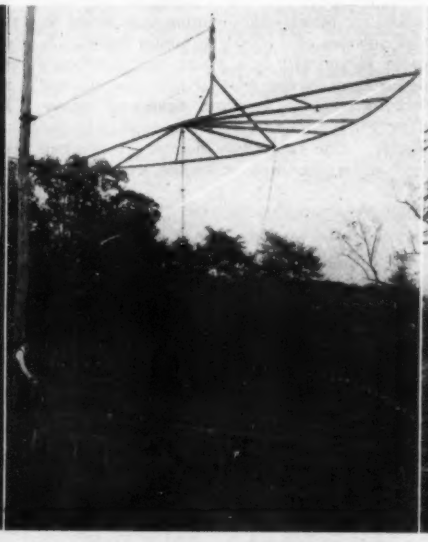
Ten-meter wave-length generating set, inductively coupled to the antenna

Theoretically, the electric wave from this reflecting system is analogous to a parallel beam of light which has obtained passage through an opening or slit in an opaque screen. The directional characteristics of the electro-magnetic waves being transmitted may be assured by one of two ways, namely, rotate the reflector while the wireless receiving apparatus is stationary, or maintain the reflector in a fixed position and vary the position of the receiving set around it in a circle. The former method was employed in these experiments. A device for analyzing the directional characteristics of the radiation of the electro-magnetic waves from the reflector was stationed 170 feet away, this apparatus being oriented as a means of collecting the greatest amount of electric energy. The parabolic reflector was rotated through 360 degrees and scale readings of the receiving galvanometer taken for every 10 degrees position of the former. The results indicate that at least 75 per cent. of the electric power radiated was restricted to an angle of 40 degrees.

Preliminary tests with different three-electrode vacuum tubes determined the fitness of the 50-watt unit of the coated-filament type. This particular type of tube operated at a wave-length of ten meters or 30,000 kilocycles. The 10-meter transmitting set involved the use of the well-known Hartley circuit. A coil of a single turn, 17 centimeters (6¾ inches) in diameter, was used for the plate coupling, while a similar coil served for the grid coupling. The capacity between the three elements of the electron tube, together with the coils,



The device used for analyzing the directional properties of ten-meter wave-lengths, this being oriented for the purpose of determining the directional effects of the transmitter



The reflecting system, consisting of 40 short wires spaced one foot apart, which was used in directing the energy in the ten-meter wave-length tests

The ten-meter heterodyne receiving set used in the reception of messages sent on the 10-meter wave-length.

formed the oscillating circuit. The experimenters observed that "it is the internal capacity which determines the upper limit of the frequencies obtainable with a given tube."

A coil bearing similarity to those employed in the plate and grid elements of the transmitting vacuum tube was used in the antenna circuit. This radiating system —or, antenna, if you please—comprised two sets of vertical wires connected by use of a coil. Each set of wires was built up of six parallel wires, arranged in a circle. These wires were spaced about 3 centimeters (1¼ inches) apart and were 1.8 meters (6 feet) in length. The manner of coupling the electric generating outfit to the antenna is shown in one of the accompanying photographs. It is seen that the coils of the plate and grid elements of this vacuum tube are supported on each side of the latter by the tube socket, thus minimizing the length of the connections.

For the purpose of faithfully determining the radiation qualities of the transmitting apparatus over short distances, a radio-receiving outfit was installed at a distance of 150 feet from the wave-reflecting system. The apparatus in question consisted of a loop of wire 31 inches in diameter. An electric tuning condenser of two-plate design, was inserted in series with this loop of wire. The tuning instrument had a maximum capacity of 20 micro-microfarads. The terminals of the loop, previously referred to, were identified with a 5-ohm thermo-couple, the output of the latter being connected to a galvanometer having a scale ranging from zero to 100 microamperes. A full scale deflection on the galvanometer was obtained when the apparatus was adjusted for maximum radiation and so long as the distance from the reflector did not exceed 170 feet. This arrangement was employed for charting a majority of the curves in studying the directional characteristics of short-wave wireless transmission.

If radio signals were to be received over a distance exceeding 150 feet, a wireless receiving apparatus consisting of three stages was employed—a detector and two stages of audio-frequency. For reception of continuous-wave signals an external heterodyne was included in the outfit. The secondary circuit of this radio-receiving unit, which consisted of a single loop of wire 12 inches in diameter, was connected to the grid and filament elements of the vacuum tube used as the detector. A vernier condenser of 0.00005 microfarad capacity was shunted across this loop as a means of facilitating the tuning of the set. A grid leak and a grid condenser of conventional design were used. The grid leak was abbreviated to the limit, thus minimizing the capacity between it and other parts of the electric circuit. The audio-frequency amplification, two stages, was not a departure from the ordinary kind.

The antenna at the receiving point—or the "ears of radio," if you please—consisted of one wire in resonance to the incoming ten-meter of 30,000-kilocycle frequency. It was coupled at its center by use of a coil to the secondary coil of the wireless receiving apparatus. The length of the wire constituting this antenna, including the single-turn of one foot in diameter wire in the center, was 14 feet 4 inches. It was fashioned from one piece of No. 12 B.&S. gauge copper wire.

Radio-telegraph signals were copied from a distance of two miles, when employing a single-turn coil antenna six inches in diameter. Also, signals were received by the use of this coil antenna when coupled to an open oscillating circuit. The strength of the wireless signals was marked. Moreover, the investigators of the Bureau of Standards express the opinion that reception of communications over a greater distance than two miles would have been possible had not the time element prevented exhaustive experiments. "Strays" (static), a bane to audible reception of wireless signals, were not encountered throughout the period of use of this antenna. The diminutive size of the latter and the extremely short wave-length are believed to have been responsible for the elimination of "strays."

Radio telephony on a 10-meter wave-length was introduced by the use of a modulating circuit, the latter facilitating tests of short-wave directive radio transmission over a considerable distance. As the parabolic reflector was rotated, its position with respect to angular degrees could be read to the radio telephone operator at the receiving end. Audibility measurements were made in the conventional manner, namely, by use of a shunt circuit across the telephone receivers. Readings were made when the strength of the radio signals were barely understandable.

The results of these experiments are responsible for conclusions setting forth certain conditions which must be met if short wave-lengths are to be successfully transmitted in a given direction. Among these requirements are: The source of the electro-magnetic waves to be reflected should be placed exactly in focus; the wires used in the reflecting system necessarily are in resonance with the source of the electric waves; and the width of the reflected wave front is dependent upon the size of the opening employed. Buildings and metallic structures absorb frequencies of 10-meters and similar short wave-lengths to a considerable extent. For instance, in the course of the novel experiments described in this article the reflected electro-magnetic waves were focused in the direction of a building 150 feet distant. The galvanometer indicated a three-quarter scale deflection; only to drop back to zero deflection when the door of this building was swung open and the wireless receiving outfit installed on the inside of this structure. Similarly, tests in the rear of the building—with the structure in the pathway of the oncoming electric waves—indicated a reduction in the strength of the wireless signals received.

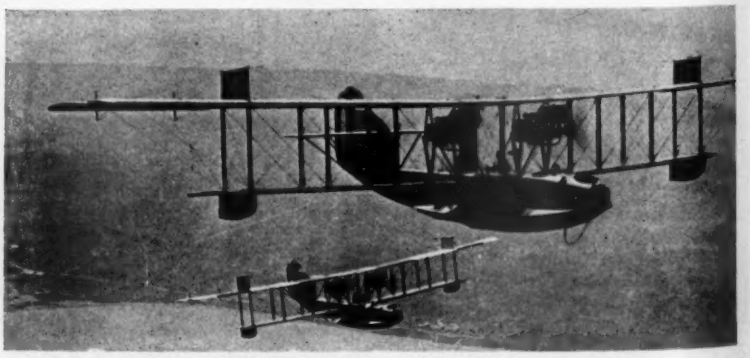
Directional antennas which are required to be of approximately the same height as the wave length on which a station is transmitting, obviously cannot be utilized for the broadcasting of market and crop reports, music, or educational lectures, but they may be employed for the purpose of reception. Then, too, the so-called "point-to-point" communication is adaptable to the use of abbreviated frequencies and antennas having directive properties. That is to say, when one transmitting station handles a great amount of traffic with one receiving station antennas with directional characteristics offer opportunity for service.

The immediate problems confronting the generation of electro-magnetic waves of the length of 10 meters are suggested by the Bureau of Standards, namely: The designing of an electron-tube radiating the proper electric energy; the development of an effective system for reflecting electric waves of this frequency, and the development of a 10-meter radio-receiving apparatus.

Electric Cable Guides Seaplane

THE seaplane F-5-L, No. 3874, was subjected to a novel experiment off the coast of North Carolina recently, when, by means of a compass, it acted in the capacity of a radio direction finder. A cable submerged at a point, not previously determined by the pilot of this aircraft was located and the seaplane navigated immediately over it, although the cable was not visible. The cable was electrically charged and when the radio compass on the aircraft approached the point where the cable was submerged, the location of the cable was easily determined.

The object of this experiment was to determine whether or not such cables could be employed as aids to aviation when flying is done in thick or foggy weather. It is assumed that submerged cables at critical points off the coasts frequented by seaplanes will serve as a means of guiding aviators safely to nearby stations.



The flying boat F-5-L radio equipped for conducting experiments with the electrically charged cable off the Carolina coast

Static Elimination Phantasies

By Carl Dreher

EVERYONE is familiar with the advertisements in rural newspapers detailing the virtues of liquid cancer cures and methods of relieving diabetes by inhaling vapors. Radio, also, has its disease: Static. And it has its nostrums and quack specialists. These people might be ignored, if it were not for the harm they do in lowering the standing of the art in the estimation of the public. Many novices build and buy apparatus in the hope and expectation that it will do things that inherently it cannot accomplish. The result is disappointment and a prejudice against all technical claims, including those which are fully warranted. On this account those who wish to see the industry built up on sound business principles will be interested in an analysis of current superstitions in the static-elimination field.

View of the nine-mile antenna at Riverhead, L. I., used for static reduction in trans-Atlantic reception by the Radio Corporation of America

There is much misunderstanding, in the first place, regarding the purpose and capabilities of the lightning arrester. The lightning arrester is a useful device and has a place, no doubt, in every well-equipped station. Its function is to provide a path for discharges of static electricity from the antenna to earth. Static electricity in this sense, however, is an entirely separate, distinct, and unrelated proposition from the "static," "strays," "atmospherics," or "X's" which make noises in the radio receiver and punctuate a broadcast concert with sounds like the discharge of a truckload of bricks. Thus the claim that a lightning arrester "frees the radio fan from concern over static interference" causes a very unfortunate confusion in the minds of many broadcast listeners.

To various people who bought lightning arresters with the idea that they eliminated crashes, grinders, clicks, and wipers, I have repeated an incisive remark once made by Dr. Alfred N. Goldsmith: "Static *is* a signal." Anything within our present knowledge which by-passes static will also by-pass the concert. All that the best lightning arrester can do is to relieve the antenna of an electrostatic charge, which, let it be noted, is noiseless, though capable of puncturing an inductance coil and doing a certain amount of damage when the potential reaches a certain level, and no alternative low impedance path is available. Many experimenters have had the experience of receiving quietly, with a variable condenser in series with the antenna, and hearing nothing but a short popping sound when a spark leaped across the short air gap between the fixed plates and the rotor. In high power stations I have often observed the lightning arresters filled with a flickering orange light for as long as two minutes at a stretch, during a snowstorm, while the operator continued to copy and not the slightest increase in the strays was noticeable. It is true that the arresters also discharge when a nearby lightning flash releases a bound charge on the antenna, with a simultaneous crash in the telephones. But this crash is just as loud with an arrester on the aerial as without one. Thus we must differentiate between "static" in the sense of a stationary charge such as may be carried by any insulated conductor, and the "static" which is the chief nuisance of radio. The nature of the latter form is discussed below.

The idea of eliminating atmospherics with a short air gap or vacuum path is ludicrous on the face of it, but certain other methods, fully as ineffective, have a more pretentious pseudo-rational basis. On the one hand, we are informed that static is audio frequency, and once you have installed a radio frequency amplifier there is nothing more to it. "Static is largely an audio-frequency phenomenon, that is, static produces audio frequency currents," announced one writer on this subject recently—after the light static summer of 1922. So he recommended a loop and two stages of r. f. But on the other hand, some writers contend that static can be reduced by sharp radio frequency tuning, on the assumption that it has a definite oscillatory period and wavelength and can be tuned out. Thus we are asked simultaneously to filter the stuff out with a radio amplifier, because it's mostly audio, and to tune sharply, because it's mostly radio. You pay your money and you take your choice.

In theory there is no reason why radio frequency amplification should reduce static interference to any appreciable extent. In practice, by people who have listened through good static years and bad ones, observation confirms the theory. Static is not an audio frequency phenomenon; according to the most competent workers in the field it is either an aperiodic discharge (Pickard, Vreeland), or a continuous spectrum of waves of different frequencies (Austin).[1] The second point to be noted is that static shock excites an antenna or any tuned r. f. circuit into oscillation *at its own frequency*, thus producing what is to all electrical intents and purposes a second signal of the same wavelength as the desired signal to which one must tune. Luckily for the feature writers and the optimists in general, most of them, apparently, have never heard of impact excitation. Yet Mr. Weagant published the theory on this point a matter of three years ago.[2] Writing of a loose coupled receiving system, he says, "A study of the behavior of such a system when acted upon by static very clearly brings out the fact that the disturbing currents which flow therein have a period and damping which is determined by the circuit itself; a fact which shows that the disturbance is in the nature of a shock, the system, when so shocked, vibrating in a way which is analogous to that of a tuning fork struck by a hammer." The phenomenon thus explained is the simple and cogent reason why a radio frequency amplifier does not eliminate static.

I speak, however, not by the book, but by the amplifier. When the first British r. f. amplifiers came over after the war, I had occasion to use one with four steps r. f., detector, and one step of a. f., at the Research Department of the Radio Corporation of America. This was a very fine amplifier, giving great magnification against a perfectly quiet field, and among other things I heard on it, one night, the British spark station at Malta in the Mediterranean Sea, from an unfavorable DX location in New York City. But when there was static, the outfit picked it up in abundance, of course. More recently I had the pleasure of listening in with Mr. A. B. Tyrrell on the evening after he heard the first verified European amateur signals in this country. Mr. Tyrrell's set included four steps of r. f. amplification, but when there was static, both of us will testify that it came through. On some nights, when there was no static, naturally none was heard. I am forced to the conclusion that our latter-day static eliminator experts do their stray-fighting on just such nights.

But what about the directive effect of the loop when this is used with radio frequency amplification? some one may protest. The answer is found in the well known reception characteristics of various forms of collectors. Figure 1 shows the ideal receiving curve of a loop. Figure 2 shows the actual "hour-glass" receiving curve of most loops, taking the antenna effect into account. Figure 3 shows the actual receiving curve of a wave antenna, in approximate scale. The lobe and two little ears represent residual receiving capacity in back of the antenna. The Radio Corporation is engaged in expensive research to eliminate these three comparatively insignificant areas, because, small as

[1] Austin: "The Relation Between Atmospheric Disturbances and Wavelength in Radio Reception," Proceedings of the Institute of Radio Engineers, Vol. IX, No. 1, Feb., 1921; and discussion following.

[2] Weagant: "Reception Through Static and Interference," Proceedings of the Institute of Radio Engineers, Vol. VII, No. 3, June, 1919.

they are, when southwest static is bad European reception is interfered with. In the light of this fact the ineffectiveness of the unaided loop is apparent. Undoubtedly some slight improvement may be secured, but it must be remembered that in eliminating heavy static we are interested in ratios much above the order of one or two. Nearby lightning induces static potentials hundreds and thousands of times those of a moderate signal. When static is bothersome, accordingly, if one makes careful tests and holds one's imagination in leash, one is forced to the conclusion that a simple loop collector is just as susceptible to QRN as a straight antenna. It is storm static we are interested in. Broadcasting stations of mentionable power ride over weak and medium static in any event. When static is heavy, on the other hand, to cut it down to half with the aid of a coil aerial is like congratulating oneself on falling out of the twentieth story of a building instead of the fortieth.

Does this mean that I disbelieve in the use of the loop and r. f. amplification? On the contrary, it is obvious that the inherent convenience of this form of reception is more than sufficient to float it; it does not need a life-preserver in the form of static reduction claims. Nothing is more probable than that non-oscillating multi-stage r. f. amplifiers, with small collecting systems, and non-critical tube characteristics so that variable filament rheostats may be discarded, will be one of the outstanding radio developments of the next few years.

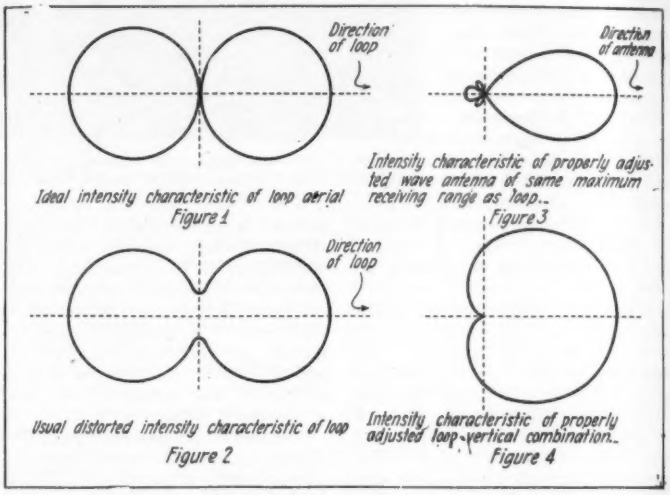
The use of coupled circuits in receiving is another measure that gives some slight relief, but not enough to enable one to say that a properly designed single circuit receiver suffers more from static than a two circuit outfit. As Mr. Frank Conrad, Assistant Chief Engineer of the Westinghouse Company, said recently in discussing the desirability of very sharp tuning in receivers,[1] "In the case of interference from atmospherics, or static, the particular precautions which would minimize interference from other transmitters would have insignificant effect, and at the present time there is no practical scheme which gives any appreciable reduction of interference from static." (In broadcast reception, that is to say.) This disposes of one of the hoariest of static myths. It is exactly as old as the thermionic amplifier. It became conspicuous first in about 1913, when the first commercial amplifiers came out. Couplings could now be made so loose, it was stated, that static would be reduced to the vanishing point. Nothing of the kind has happened. Loose coupling is slightly advantageous, but as long as we must adhere to tuned circuits subject to shock-excitation by strays, only a negligible improvement can be expected from this source.

Of many more abstruse methods than those reviewed, such as balanced rectifiers, Dieckmann and Faraday cages, including earth antennas, and so on, I shall say nothing. Like the simple schemes, they don't work. But it is profitable, before going on to a discussion of methods which do give some degree of relief from static disturbances, to inquire why people believe in the effectiveness of loose coupling, low decrements, the simple loop antenna, radio frequency amplifiers, and other such fetishes. These ideas are propagated, in the main, by persons who have not tried them, or who have some direct interest in making others believe that they will work. But what about the honest experimenters who believe that they have something valuable, when in reality they have precisely nothing? What these need, principally, is a stiff course in skepticism. In scientific work the will-to-believe is fatal. Everyone hopes for success, and it is only too easy to let hopes affect one's eyesight and hearing.

A few years ago Prof. M. I. Pupin remarked that at a crucial point in an experiment or development he has a student or assistant read the meters, whenever possible, so that he may get the benefit of unbiased observations and not be led into over-optimistic conclusions. This from one of the leading electro-technicians of the day, from a man who has spent thirty years in large scientific and engineering enterprises! Yet amateurs and radio manufacturers who a year ago did not know radio frequency from theosophy, do not hesitate to listen in once or twice on a set and then to rush into print with the announcement that they have succeeded where such men as Pupin have attained only a small measure of improvement.

Many other physico-psychological factors enter into the problem and are usually ignored. It is very difficult to gauge the extent of static interference except by short successive listening periods. Obviously tests on succeeding nights are worthless. In summer, as well as in winter, a night in which amateur stations in the same district are buried under crashes may be followed by one in which almost total quiet prevails. The only reliable method is to compare the set in question with a standard apparatus *in correct adjustment*, and to switch over from one to the other with only a brief interval. The effect of loudness is also very deceiving. The two sets should be adjusted to give about the same volume of signal, or the reliability of the comparison is dubious. Decreasing the audibility always gives the impression of less static relative to the signal. But in telegraph reception, when one tries copying with the fainter signal, one finds that copy is as mutilated in the one case as in the other. Comparisons in telephone reception are an even more delicate proposition. How many people who claim efficacy for some method have actually made successive tests, and found that what was easily understandable in one case was badly broken up in the other? If more experimenters took this precaution there would be fewer Pollyannas in radio research.

Another trap for the unwary lies in the fact that any method of reception, properly used, will give better results in the way of signal-to-static ratio, as well as speech quality, than any other method improperly used. Without doubt an r. f. amplifier, in stable adjustment, delivering a moderate volume of signal, will give superior reception in comparison to an a. f. outfit suffering from incipient howling, and forced to the limit of its amplification. But the latter receiver would do just as well as an r. f. outfit similarly misused. Excessive amplification, incipient or actual howling, limiting and distortion, and generally erratic operation of equipment, have done more to fool people as to the effects of static, and to exaggerate the magnitude of static interference in the mind of the public, than anything inherent in the natural disturbances themselves. The best cure for static, it might almost be said, is decent operation of existing equipment. Certainly it is the first remedial measure in order. Yet its first principles are often ignored. Consider the effects of limiting, for example. Although some practitioners do not appear to realize it, it is a fact that the output of a receiver may be expected to be a finite quantity. Bearing this in mind, let use take the case of isolated static crashes somewhat heavier than the signal. If one forces the volume of the signal up to the limit of response of the equipment, whenever a crash comes in the signal disappears entirely. With a properly adjusted receiver the crash would be audible, to be sure, and it would shake the signal up considerably, but the disturbance would not be nearly as grave as when the signal drops out altogether. This is the fallacy of static-limiting in general; it limits out the signal, not the static. The only time it helps is on very short clicks, and these are not the seriously-interfering form of strays in any case. At


Direction of loop
Direction of antenna
Ideal intensity characteristic of loop aerial
Figure 1
Intensity characteristic of properly adjusted wave antenna of same maximum receiving range as loop.
Figure 3
Direction of loop
Usual distorted intensity characteristic of loop
Figure 2
Intensity characteristic of properly adjusted loop-vertical combination.
Figure 4

Reception characteristics of certain types of antennae

[1] Conrad: "Radio Receiving Equipment," Proceedings of the Institute of Radio Engineers, Vol. X, No. 6, Dec., 1922.

any rate, in telephone reception limiting always involves distortion, and so may be regarded as an unmitigated evil.

Together with proper operation of receiving equipment and due regard for its physical characteristics, considerable improvement has been obtained in reception through static by the use of *sharply* directional systems. Besides the wave antenna, now becoming well-known among amateurs with room for its installation, there is every expectation that on many occasions good results could be obtained with, not a simple loop, but a loop-vertical balance, as devised by Pickard and modified by Austin and others. The intensity curve of such a balanced system is shown in figure 4. This is the familiar cardioid or heart-shaped diagram. For connections, the reader is referred to Pickard's original paper;[4] as for constants at 360 meters, these will have to be worked out by the experimenter. This is a promising field for those interested in the actual reduction of static disturbances, as distinguished from verbal elimination. The results cannot be as good as those which may be expected from the much sharper directivity of the wave antenna, but the consideration of space rules out the latter in many cases where small loop and straight antennas could be installed. It should be remembered, however, that a directional system is in general effective only when the static itself is mainly confined to a narrow sector of the compass, and that making a considerable angle with the direction of the broadcasting station.

Finally, it may be stated that with broadcasting stations of adequate power, static, while still constituting a problem of major importance, is by no means a fatal obstacle to the progress of the art. One of the best means of eliminating static interference is to eliminate the 20-watt broadcasting transmitter. How long would a public lecturer expect to hold the attention of his audience, if his voice was so feeble that any cough or movement in the audience made him inaudible? Personally, I doubt if any radical progress will be made in the solution of the static problem, using apparatus adaptable to unskilled operation. Of course, one can never tell; the thing may happen. One should never become ingrained in pessimism, any more than one should hail gladly methods of elimination that do not and cannot function. But even if no further progress is made in this direction, improvements in the transmitting stations will raise broadcasting to the level of efficiency of other public utilities, as is already the case in many sections of the country. After all, the telephone, the telegraph, the theatre, transportation facilities, give good, not perfect, service. If, when the industry has settled down to an entirely stable basis, an occasional crash of static still intrudes, we shall take it philosophically, like the rush hour in the subway, or a wrong number on the telephone, or a bad vaudeville act.

[4]Pickard: "Static Elimination by Directional Reception," Proceedings of the Institute of Radio Engineers, Vol. VIII, No. 5, Oct., 1920.

Patents and the Public

By James G. Harbord
President, Radio Corporation of America

A REMARKABLE feature of the development of radio in this country has been the free manner in which the amateur has been able to use patented inventions, and the enormous amount of effort, and money that has been spent in making this possible, and in making it possible for the amateur to obtain the most modern and up-to-date devices, such, for example, as vacuum tubes.

The changes which have taken place in radio during the last ten years are so considerable, and the number of new and patentable devices and "hook-ups" which are used in the average amateur station are so great, that it will be obvious without argument that the average amateur must be using a number of patentable inventions which are so recent that there is every reason to assume that the patents are still alive.

The object of the patent law is to encourage invention; it has been found by experience that the best way to encourage invention is to give the inventor, for a limited term of years, the exclusive right to that which he has invented. Thereafter, the public gets the invention for nothing. That system gives the inventor who produces a new patentable invention not the positive right to make, use or sell, but merely the right to prevent others from doing each of these things.

When a man patentably improves a fundamental patented invention, he also is entitled to a patent; he is entitled to the right to keep others, including the original broad inventor, from using his particular improvement. At the same time, the original broad patentee has the right to prevent the improver from utilizing the broad invention. Here an impasse is necessarily created.

When the European War closed, with the signing of the Armistice, the patent situation in the United States with reference to radio was hopelessly involved. For example, the fundamental Fleming patent, which covered the vacuum tube, was owned by the American Marconi Company, while the DeForest improvement patent, usually known as the "grid" patent, was owned by the American Telephone & Telegraph Company, and other very important improvement inventions were the subject of controversy in the United States Patent Office between the General Electric Company and the American Telephone & Telephone Company. No one concern could manufacture the modern vacuum tube without infringing patent rights held by others. The most usual connection of the valve for reception purposes was covered by the Armstrong patent, held at that time by Armstrong himself.

When, in response to the suggestion of the Director of Communications of the United States Navy, the formation of an American Radio Corporation was undertaken, it was realized that one of the most vitally important things that had to be done was to clear the patent situation so that it would be possible to embody in one vacuum tube, or in one piece of apparatus, a sufficient number of patented inventions to make that tube or apparatus satisfactory for use in a trans-oceanic reception station.

To bring this about, it was necessary for the Radio Corporation to acquire rights from the American Marconi Company, from the General Electric Company, from the American Telephone & Telegraph Company and from the Western Electric Company. But this was not enough. The important patents of Fessenden were owned by the International Company, in which the Westinghouse Electric & Manufacturing Company was interested, and the Westinghouse Company by that time owned, subject to certain licenses, the very important Armstrong "regenerative" patents.

By years of hard work, and by great sacrifice, these difficulties and other patent difficulties were overcome, and the Radio Corporation found itself free to go ahead, so far as the patents of these various groups were concerned.

The Radio Corporation had the absolute right to enforce every patent right which it owned against every user. It did not, however, adopt this policy, but instead decided on a policy which is entirely in keeping with the high ideals which have characterized its policy since its inception. The Radio Corporation decided that if an amateur wanted to build his own set, for his own amateur use, he could do so, and that it would not, until further notice, treat such procedure as an infringement of its patent rights.

But there is absolutely no reason why the Radio Corporation, which ought to earn dividends on the shares which it issued to acquire this property represented by important patents, and which shares are now owned by thousands of stockholders, should allow this property in patents to be recklessly trespassed upon by hundreds of rival manufacturing companies most of which make no contribution whatever to the art, have made no investment in property patent rights, and merely attempt to "reap where others have sown."

The Radio Corporation is, therefore, proceeding to enforce some of its rights by the normal, orderly process of suit in the Federal Courts. It is not attempting to create a monopoly; it is attempting to enforce the lawful rights, limited in scope and in time, which it has been necessary for it to acquire in order that the radio art might go forward.

In some cases the Radio Corporation has purchased patents outright; in other cases it has taken exclusive licenses; in some cases its licenses were not exclusive. In the particular case of the Armstrong regenerative patents—not the super-regenerative—the Radio Corporation's exclusive license in its field is subject to a number of non-exclusive licenses which were granted some years ago by Major Armstrong, not by the Radio Cor-

poration. The Radio Corporation, when it purchased the rights which it holds under these patents, naturally took them subject to whatever prior licenses had been granted. This means that there are a number of concerns in this country which have certain licenses under the Armstrong regenerative patents. But it will be obvious, under the circumstances, that these licensees have no rights under the other patents of the Radio Corporation.

The soul of modern radio is the vacuum tube. When the Radio Corporation started to clear the patent situation, the most difficult and the most important patent problem before it was to acquire the necessary rights with respect to vacuum tubes, since without the vacuum tube it would be impossible to construct a receiving system for transoceanic telegraphy capable of giving the character of service which the Radio Corporation wished to give.

When this situation was cleared up, the Radio Corporation faced another question—this time, a question of policy; namely, whether or not, and to what extent, it could satisfy the urgent demand of the amateurs for vacuum tubes. If satisfying that demand incidentally involved selling for a few hundred dollars tubes enough to double the value of millions of dollars worth of transoceanic transmitting and receiving stations; if it meant that merely by purchasing tubes from a dealer any rival concern could secure for a few dollars the rights which had cost the Radio Corporation so much effort and sacrifice—surely the Radio Corporation would never have sold a tube! But the amateurs wanted tubes, and the Corporation was willing and anxious to let them have them; glad to see the art advance in this way and glad to get whatever profit there was in the tube business—but only if it could sell the tubes for legitimate uses.

Some of the patent claims cover the tube; others the combination of the tube with certain circuits or circuit elements. The Corporation is willing that the amateur should construct, in good faith and for his own amateur use, the circuits in question, and incorporate in such circuits the tubes which the Radio Corporation sells for that purpose.

But the Radio Corporation is not willing that the policies which it pursues for the benefit of the amateur, should be made the basis of an attack on its fundamental rights. It is not willing, for example, that tubes sold by it for amateur use only should be used by rival communication companies, as is actually being done.

Further, it is not willing that rival manufacturers should construct and sell sets which, when once a tube is placed in them, will infringe the Radio Corporation's patents. It was not for such purposes as these that the Radio Corporation cleared the road.

This infringer has the advantage, in that he has no patent investment, no research to finance, no responsibility to the art. He can make a thing and sell it; if he makes a dollar profit the dollar is his—until the courts take it away from him, which can only happen after a long litigation. The thousands of stockholders who have associated themselves together as the Radio Corporation, have made all this development possible; it has spent millions in clearing the road for American radio, and has to earn something on what it spent in clearing the road. The enforcement of its patent rights by the Federal courts will help it to earn that something. If its rights are not as broad as it believes them to be, the courts will say so. In its efforts to test its rights, to find out just what they really are, and to enforce them, the Radio Corporation should have the sympathy of everyone who really wishes the good of the radio art, for if such rights, acquired under such circumstances and at such cost, are not sustained and enforced, who again will feel justified in taking such risks and making such expenditures as were taken and made when the Radio Corporation was formed?

Design of a Trap Circuit

By Samuel C. Miller
Member I. R. E.

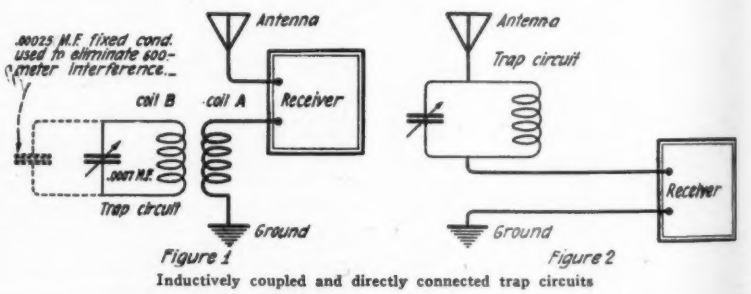
IN some locations, the owner of a receiving outfit has considerable difficulty in eliminating interference which may be due to a broadcasting station transmitting on another wave length or to a commercial or amateur spark station with a low decrement, forcing by shock excitation, its impulses into the receiver. The above conditions may exist even should the receiver be of the highly selective type, with much more interference of course if the receiver is not so selective. The result is that the owner of the outfit becomes discouraged at the continual breaking in on a program with dots and dashes from a spark station or the intermingling of one concert with another. Should the interference be so slight as not to be discernible during the presentation of a program, however the interference will cause distortion. Though this is not apparent to the listener of a newly bought set, due to inexperience in operating, as the novelty gradually wears off and the owner becomes more critical about the quality of signal, he will want to remedy the cause of distortion.

The interference can be eliminated in two ways. The first is only applicable to double circuit tuners and is done by shielding the entire secondary circuit in such manner that only magnetic coupling is obtained between primary and secondary coils, the secondary coil being electrostatically shielded. The incoming interfering signal is then prevented from being directly induced into any part of the secondary circuit and can only be picked up by the antenna circuit. Sharp tuning of the primary and secondary circuits will entirely eliminate the interfering signal. This method is not practical for the average listener as it requires almost an entire rearrangement of parts and careful shielding.

The second method for eliminating interference is by the use of a trap circuit. The trap circuit to be described in detail was used very effectively in eliminating undesirable signals even though the station to be eliminated was situated very close by. The interfering stations were either another broadcast station operating on 380 meters, a commercial spark on 600 meters and an amateur around 230 meters. In the specific case, WEAF on 380 meters was situated only 5 miles from the receiver and it was impossible to tune him out when receiving WJZ on 360 meters. Again, when a distant station was desired operating ten or fifteen meters above or below WJZ or WEAF when either of these stations were transmitting, they would cause enough interference to make long distant reception impractical at that time. With the trap circuit no difficulty was experienced from interference which could be eliminated entirely with very little loss in signal intensity of the station tuned in.

The circuit used in the trap is very simple in construction as shown in figure 1 and consists of a variable condenser and two fixed coils. Attention is called to a feature not found in trap circuits as presented before. It is the use of a separate coil designated as "A" coupled to the trap circuit inductance "B," instead of the usual method of inserting the trap circuit directly in the antenna lead as in figure 2. By the use of coupling coils, the trap circuit tuning has very little effect on the antenna tuning. When inserting the trap circuit as in figure 2, any change in the trap circuit tuning would require retuning of the receiver.

The design of the trap circuit can be seen by looking at figure 3. The coils are marked "A" and "B" with "A" as the coup-



Inductively coupled and directly connected trap circuits

ling coil and "B" as the trap circuit inductance. Coil "A" is 2½ inches in diameter and is wound with 30 turns of No. 32 double cotton covered wire. It is placed inside of coil "B" which is 3 inches in diameter and is wound with 30 turns of No. 22 double cotton wire. Both coil forms are 2 inches wide and can be made of either bakelite or cardboard tubing. Two separators are placed between the coils and are made from ⅜ inch bakelite rod with a No. 27 drill hole in the center which is clearance for a No. 6-32 screw. Two ⅜ inch bakelite pieces with the same size holes in the center as in the separators are used to fasten the coils to the base, the No. 6-32 screws also acting as fastening screws.

For tuning out the interfering signals, a variable condenser with a .0007 mfd. capacity is used. The wave length range obtained with the coil described above is between 200 and 475 meters and in order to eliminate 600-meter interference it was necessary to place an .00025 mfd. fixed condenser across the variable condenser terminals.

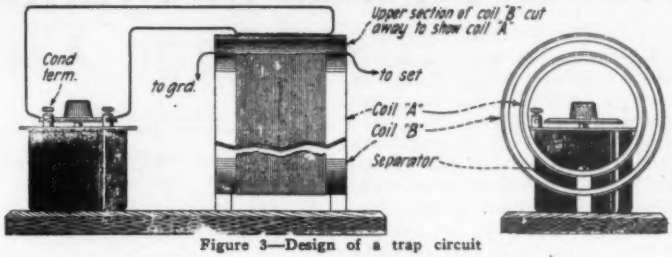


Figure 3—Design of a trap circuit

To operate the trap circuit, the receiver is tuned to the desired signals as usual, and then the variable condenser of the trap circuit is rotated until it is in resonance with the interfering signal. This will cause the trap circuit to absorb the energy of the interfering signal and prevent it from being induced into the receiver system.

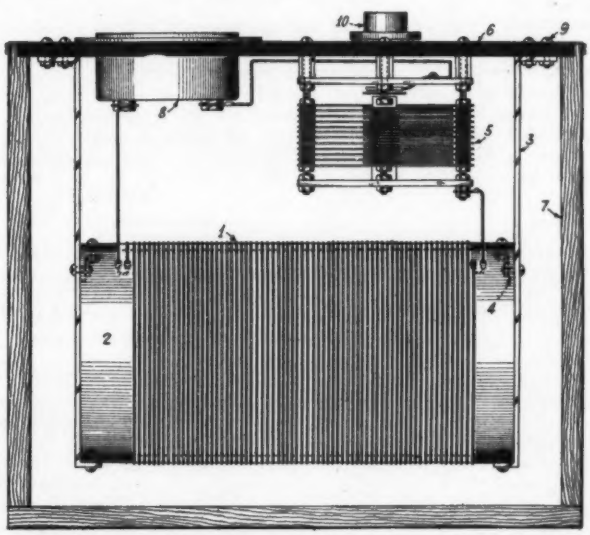
Frequency Indicator for Broadcasting Stations

By S. R. Winters

AMONG the recommendations promulgated by the second session of the conference on radio, called by Secretary of Commerce, Herbert Hoover, was one to the effect that each of the approximately 500 broadcasting stations in the United States should be equipped with apparatus for keeping the radio frequency within two kilocycles of the assigned transmitting wave-length. J. H. Dellinger and L. E. Whittemore of the Radio Laboratory of the Bureau of Standards were among the government representatives at this conference, and they immediately started on the design of a radio-frequency indicator for broadcasting stations, and a standardized meter has now been developed.

This instrument, consisting of a coil, air condenser, and thermo-galvanometer connected in series, was designed for the purpose of indicating a single wave-frequency. Structurally, the coil is wound on a substantial tube, the latter being of insulating material of unquestioned quality. The tubing is 7½ inches long by 3¾ inches in diameter, outside dimensions. The walls thereof do not exceed one-eighth of an inch thickness. The winding of the tube is accomplished in this wise: Beginning at a point three-fourth of an inch from the end of the tubing, 72 turns of No. 18 B.&S. gauge DCC copper wire are placed thereon. At the same time, a No. 22 B.&S. gauge DCC wire is threaded around the tubing, this merely acting as a guide for spacing the windings of No. 18 wire, and the former is subsequently displaced. A coating of spar varnish is then applied to the coil. Once the varnish has become dry, the No. 22 wire is removed from the tubing, leaving the 72 turns of No. 18 wire. The latter is treated with two coats of spar varnish.

The radio-frequency indicating device proper involves the use of a portable design of thermo-galvanometer. The full scale deflection of this resonance indicator should provide for an electric current not exceeding 125 milliamperes and a resistance of not over 8 ohms.



Radio frequency indicator for broadcasting stations—(1) Coil 72 turns No. 18 D.C.C.; (2) 3¾"x7½" tubing; (3) brass coil supports, ⅛"x½"x7"; (4) brass angles, ⅜"x½"; (5) variable air condenser; (6) insulated top panel; (7) box; (8) indicating instrument; (9) 6/32 brass bolts and nuts; (10) locking device

The constancy of the capacity of the variable air condenser, once this electrical device is fixed in a specified position, is a requirement emphasized by the Radio Laboratory of the Bureau of Standards. Snug fitting of the bearings, a condition that forbids either vertical or horizontal play of the shaft, is a prerequisite of the condenser employed in this capacity. The fixed or movable plates should not lend themselves to warping or sagging, and this instrument should not develop such defects in the course of reasonable service.

The use of types of condensers having either or both bearings of the rotating plate shaft supported on springs is discouraged. The preferred ways of mounting the rotating plates are thus outlined: First, metallic cone or cup bearings at both ends of the shaft; second, metallic cone or cup bearings at base of shaft with close fitting metal-insulating material bearings at the other end; and, third, close fitting metal-insulating material bearings at both ends.

A metallic contact notably, the spiral spring or "pig-tail" with the rotating members, is preferable. In the absence of this design of condenser, electrical devices which have either or both bearings of metallic cone or cup type will answer the requirements. Certain types of devices which form contacts by lateral or in spring friction are not to be relied upon as an integral part of this radio-frequency indicator. The maximum capacity of the condenser selected for this specific service should vary between 0.0005 and 0.0008 of a microfarad. The condenser should be equipped with a locking device.

Secretary of Commerce Herbert Hoover and his co-laborers in the formulation of regulation for governing the operation of wireless transmitting stations are positive in their recommendations in this particular, to wit: "That every broadcasting station shall be equipped with apparatus such as a tuned circuit coupled to the antenna and containing an indicating instrument or the equivalent for the purpose of maintaining the operating wave-frequency within two kilocycles of the assigned wave-frequency."

The design of radio-frequency indicator for wireless transmitting stations is an expansion of the service which the Radio Laboratory of the Bureau of Standards has been and is now rendering in the transmission of standard wave-lengths for the benefit of owners of wireless receiving sets whose outfits are in need of adjustment. The latter makes for correct tuning, while the radio-frequency indicator would enable broadcasting stations to "toe the mark" of their assigned transmitting wavelengths.

The Radio Laboratory of the Bureau of Standards will adjust and set the instruments at the specified transmitting wave-frequency, accurately within three-tenths of one per cent. for a nominal charge of five dollars.

Radio Signals of Standard Frequency

THE transmission of radio signals of standard frequency by the Bureau of Standards (Station WWV) has been previously mentioned in its Bulletin. The following is a schedule of the signals which will be transmitted during the next four months and should prove of interest to the operators of all stations which transmit on frequencies above 425 kilocycles, as they may be used for checking wavemeters and adjusting transmitting and receiving apparatus. The accuracy of these signals is better than 0.3 of one per cent. More details may be obtained from Letter Circular 92 which will be supplied on application to the Bureau of Standards, Washington, D. C.

Commercial and ship stations should be especially interested in the 425, 500, and 600-kilocycle waves, since the 425 k.c. wave is the new frequency allotted by the Department of Commerce for commercial ship traffic. The remainder of the schedule includes frequencies used by broadcasting and amateur stations, the transmissions on the morning of October 7 being especially for such stations and including only frequencies used by them.

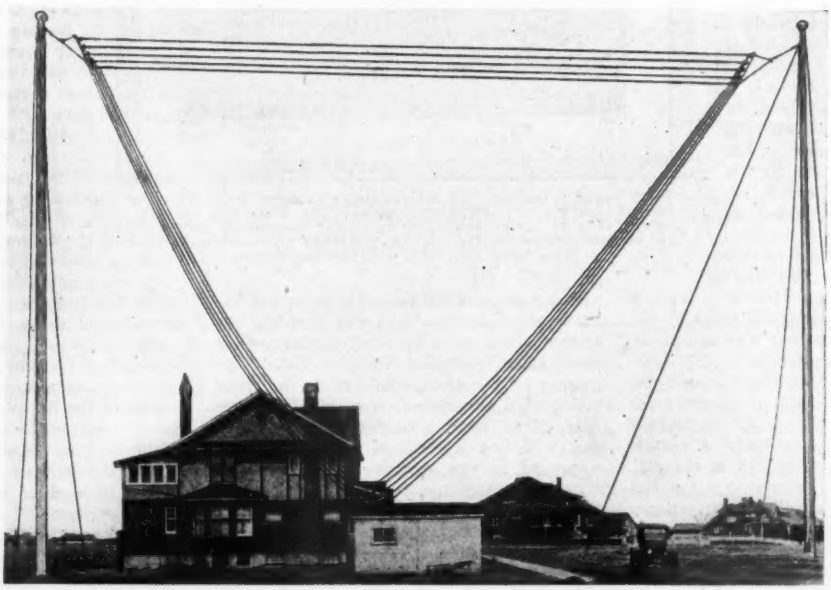
In the foregoing schedule the general call is given by voice during the first half of the four-minute period and by continuous wave telegraph during the second half. This call is given to enable listeners to tune in "WWV." The "standard frequency signals" consist of the call letters "WWV" repeated with very long dashes intervening and are transmitted by unmodulated continuous waves. The "announcements" are made by voice during the first half of the period and by continuous wave telegraphy during the latter half. The general call and the announcements are made on the same frequency as the standard frequency signals and may be used for some measurement purposes, but it is recommended that accurate measurements be made on the standard frequency signals only. With sensitive receiving apparatus, it should be possible to receive these signals anywhere east of the Mississippi River.

SCHEDULE OF TRANSMISSION

Eastern Std. Time	Signal	Kilocycles Aug. 15	Kilocycles Sept. 13	Kilocycles Sept. 28	Eastern Std. Time	Kilocycles Oct. 7
10:55-11:04	General Call	425	425	500	1:55-2:04	1350
11:04-11:08	Wave length	(705)	(705)	(600)	2:04-2:08	(222)
11:08-11:11	Announcements				2:08-2:11	
11:15-11:19	General Call	500	500	700	2:15-2:19	1500
11:19-11:23	Wave length	(600)	(600)	(428)	2:19-2:23	(200)
11:23-11:26	Announcements				2:23-2:26	
11:30-11:34	General Call	666	666	900	2:30-2:34	1600
11:34-11:38	Wave length	(450)	(450)	(333)	2:34-2:38	(187)
11:38-11:41	Announcements				2:38-2:41	
11:45-11:49	General Call	850	850	1100	2:45-2:49	1700
11:49-11:53	Wave length	(352)	(352)	(273)	2:49-2:53	(176)
11:53-11:56	Announcements				2:53-2:56	
12:00-12:04	General Call	1000	1000	1300	3:00-3:04	1800
12:04-12:08	Wave length	(300)	(300)	(231)	3:04-3:08	(167)
12:08-12:11	Announcements				3:08-3:11	
12:15-12:19	General Call	1250	1250	1500	3:15-3:19	1900
12:19-12:23	Wave length	(240)	(240)	(200)	3:19-3:23	(158)
12:23-12:26	Announcements				3:23-3:26	
12:30-12:34	General Call	1500	1500	1700	3:30-3:34	2000
12:34-12:38	Wave length	(200)	(200)	(176)	3:34-3:38	(150)
12:38-12:41	Announcements				3:38-3:41	

The time indicated above from 11:00 to 11:56 is P. M., and from 12:00 to 12:41 is A. M.

IN response to many requests from our readers we are printing this illustration of the 120-foot loop used in the 1,000-mile broadcasting transmission described on page 54 of the June issue of THE WIRELESS AGE.



Broadcasting, consisting of speech and music, transmitted from this loop has been heard frequently in the plane of the loop for 1,000 miles, while at points broadside to the loop, but much nearer, the station has not been heard, denoting very marked directional effects.

A Radio-Telephone Receiver With Simplified Controls

By E. T. Jones

THIS is my conception of the real radio telephone receiver for the novice. I acknowledge the fact that even though I conceived the design I am not in a position to construct it—because of the lack of the necessary tools. Some progressive experimenter with a fair workshop, however, can undoubtedly put these ideas to very good use.

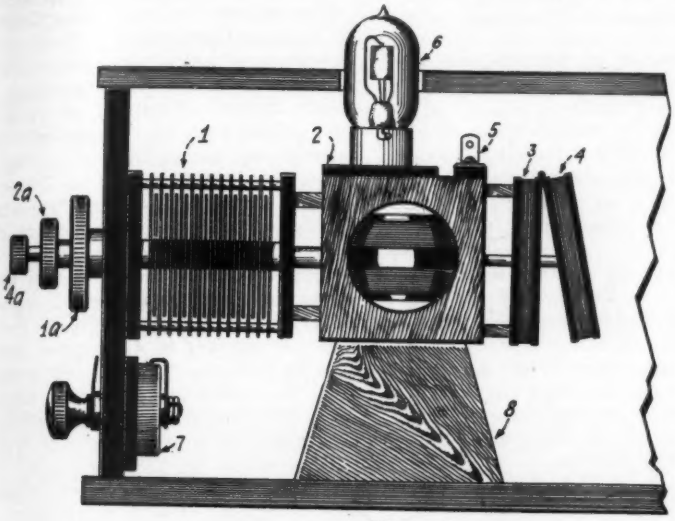


Figure 1

Design of the simplified control radio-telephone receiver

The main idea is to confine the tuning to one area having a radius of four inches at the most. A fourteen-plate condenser and one variometer of special design (mechanical) must be constructed. Two small coils in the feed-back circuit are also special.

Note that the variable condenser, 1, is controlled by the largest knob, 1-A; the variometer, 2, by a knob just a little smaller than the condenser knob and indicated by 2-A; the tickler coil, 4, which is in the plate circuit of the tube, is either brought away from or towards coil 3—which is in series with it. A small wooden support (8), for the variometer being centrally located between the condenser and the tickler, takes the strain off the panel to which the condenser is mounted. The filament rheostat is represented at 7.

Pointer of knob 1-A reads from the panel; pointer 2-A reads from the face of knob 1-A, and there need not be any marker for the tickler handle which is pushed in or pulled out as is necessary to cause regeneration.

In the diagram the variable condenser is shown at 1; the variometer at 2; a small coil 3, is connected in series with the variometer and to it is coupled the coil 4, which is connected in the plate circuit of the vacuum tube; 5 is the ordinary grid condenser; 6 represents the socket and vacuum tube; 7 the filament rheostat; 9 the 22½-volt "B" battery; 10, telephone receivers; 11, earth or ground connection; 12, the antenna, and 13, the 6-volt storage battery, or in the case of the WD-11 Westinghouse tube, the 1½-volt dry cell.

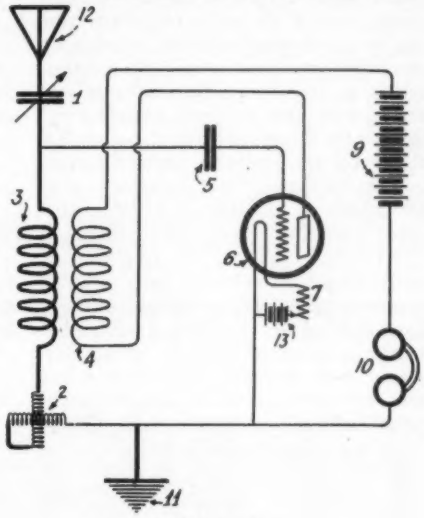


Figure 2

Hook-up of the simplified control receiver

Such a receiver as this would permit one to learn the essentials of tuning very readily and would confine all the adjustments to one place—rather than having knobs all over the front of a large panel.

The circuit works extremely well on short waves and with one tube many of the powerful broadcast stations over 1,000 miles distant have been heard in sufficient volume to satisfy any listener.

Rules for Wartime Use of Radio Adopted by International Agreement

A COMPLETE code, governing the use of radio in time of war, is the unique feature of the agreement on war rules by representatives of the Governments of the United States, France, England, Italy and Japan, assembled at The Hague under authority of a resolution adopted at the Washington Arms Conference. It is the first time such a code has been drafted.

The text of the new rules, which were made public by agreement simultaneously at Rome, Washington, Tokio, Paris and London, is as follows:

Article 1.—In time of war the working of radio stations shall continue to be organized as far as possible in such manner as not to disturb the services of other radio stations. This provision does not apply as between the radio stations of opposing belligerents.

Article 2.—Belligerents and neutral powers may regulate or prohibit the operation of radio stations within their jurisdiction.

Article 3.—The erection or operation by a belligerent power or its agents of radio stations within neutral jurisdiction constitutes a violation of neutrality on the part of such belligerent, as well as on the part of the neutral power which permits the erection or operation of such stations.

Article 4.—A neutral power is not called upon to restrict or prohibit the use of radio stations which are located within its jurisdiction except so far as may be necessary to prevent the transmission of information destined for a belligerent concerning military forces or military operation, and except as prescribed by Article 5. All restrictive or prohibitive measures taken by a neutral power shall be applied impartially by it to the belligerents.

Article 5.—Belligerent mobile radio stations are bound within the jurisdiction of a neutral State to abstain from all use of their radio apparatus. Neutral Governments are bound to employ the means at their disposal to prevent such use.

Article 6.—(1) The transmission by radio by a vessel or an aircraft, whether enemy or neutral, when on or over the high seas of military intelligence for the immediate use of a belligerent is to be deemed a hostile act and will render the vessel or aircraft liable to be fired upon. (2) A neutral vessel or neutral aircraft which transmits when on or over the high seas information destined for a belligerent concerning military operations or military forces shall be liable to capture. The prize court may condemn the vessel or aircraft if it considers that the circumstances justify condemnation. (3) Liability to capture of a neutral vessel or aircraft on account of the acts referred to in Paragraphs 1 and 2 are not extinguished by the conclusion of the voyage or flight on which the vessel or aircraft was engaged at the time, but shall subsist for a period of one year after the act complained of.

Article 7.—In case a belligerent commanding officer considers that the success of the operation in which he is engaged may be prejudiced by the presence of vessels or aircraft equipped with radio installations in the immediate vicinity of his armed forces or by the use of such installations therein. He may order neutral vessels or neutral aircraft on or over the high seas: (1) To alter their course to such an extent as will be necessary to prevent their approaching the armed forces operating under his command, or (2) not to make use of their radio transmitting apparatus while in the immediate vicinity of such forces. A neutral vessel or neutral aircraft, which does not conform to such direction of which it has had notice exposes itself to the risk of being fired upon. It will also be liable to capture, and may be condemned if the prize court considers that the circumstances justify condemnation.

Article 8.—Neutral mobile radio stations shall refrain from keeping any record of radio messages received from belligerent military radio stations unless such messages are addressed to themselves.

(*Continued on page* 81)

Putting a Complete Station in a Chest

THE sailor's chest, the tool chest, and the medicine chest are proverbial, but the radio chest is a fresh application of this form of wooden container. A duplex radio set, capable of transmitting and receiving radio telegraph signals, recently devised for use by the Signal Corps of the United States Army, may be snugly enclosed in a chest and transported from place to place by hand. The carrying strap is the only projection from the two-compartment box, although on the inside are to be found radio-installation tools, condensers, storage batteries, telephone receiver, switches and other appliances necessary for radio-telegraph transmission and reception.

This compactly built outfit for service afield is of the quenched-spark type, and the Signal Corps labels it "SCR-105." When an amplifier is used with the receiving unit, reliable communication can be maintained over a distance of thirteen miles; otherwise, in the absence of a stage of amplification, two of these portable wireless sets can effectively exchange intelligence when located five miles apart. The operating wave lengths of the transmitting apparatus are fixed at 150, 180, 210, 240, 270 and 300 meters. The receiving unit lends itself to tuning for the reception of damped and audio-frequency modulated continuous waves at any frequency between 100 and 550 meters. The Signal Corps indicates that the equipment is only intended for service at intervals and continuous operation is not countenanced. Therein, not unlike the tool and medicine chests, the radio chest may be characterized as emergency equipment.

The wooden box weighs approximately 24 pounds, and its dimensions are 15½ by 6 by 13 inches high. Not unlike the arrangement of a small trunk, this chest resolves itself into two distinct compartments. The lower section, hinged at the back and fastened at the front, is a receptacle for the telephone receiver, cords, tools and spare parts. The upper compartment, subdivided by a shelf, carries condensers, inductance coils, switches and other units composing the transmitting and receiving apparatus. A canvas flap folds down over the front of the chest as an added protection to its contents when unfavorable weather conditions prevail. The top of the wooden box is provided with a hinging arrangement which facilitates easy accessibility to the instruments most liable to need regulation. Adjustments in both the transmitting and receiving of wireless signals can be effected

External appearance of the radio chest

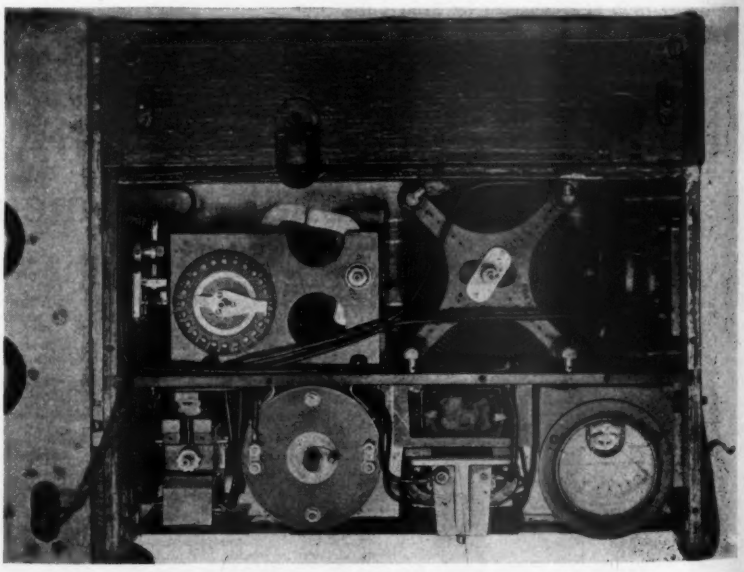
on the outside of the compact container, excluding the changing of the sending wavelength.

The portable outfit, when divided according to logical classifications, resolves itself into three distinct units—power supply, antenna and operating chest. The battery unit weighs 26 pounds and is equipped with a strap for carrying. It is a type BB-29 storage battery, a 10-volt lead plate unit in a non-spillable case, with a 20-ampere-hour capacity. Three of these batteries are assigned for service, as follows: One in service with the outfit, another when fully charged to be taken with the set as a spare battery, and still a third battery retained at the charging point.

The antenna is supplied in the form of an inverted "L," 20 feet high, 75 feet long, with a "lead-in" wire 25 feet long. Two bamboo masts, each with two guys, are supports for the antenna system. Each bamboo mast has two sections, coupled together. The "ground" for the antenna may be either a counterpoise or mats. The latter, two in number, are of coarse copper-wire mesh, each being 9 by 12 feet in dimensions. The counterpoise involves the use of two heavily insulated wires, each 75 feet long. Experiments conducted by the Signal Corps have determined the electrical constants of this antenna system to be: Inductance, 0.037 millihenry; capacity, 0.000131 microfarad; fundamental wave length, 130 meters; resistance, 50 ohms.

The transmitting unit of this set is a 50-watt quenched-spark design, with an open gap deriving its electric energy from a buzzer transformer. The inductances of the primary and secondary electric circuits of the oscillation transformer are conductively coupled, and are variable in six steps, controlled by means of a "wave-change" switch. Likewise, there is a variable antenna tuning inductance of 11½ turns in the secondary, thus permitting of precise adjustment of the resonance of the primary and secondary circuits. A coupling switch governs the amount of inductance common to both the primary and secondary, thus affording a variable coupling. A Weston thermo-ammeter, in the antenna-to-ground circuit, reflects the current in the antenna system.

Novices and amateurs generally will be interested in a brief description of the design of the buzzer transformer. It has two primary windings so arranged as to give opposite magnetic effects when carrying an electric current. It employs five amperes at ten volts. By use of a vibrator which forms contact first with one primary winding and then the other, there is produced in the secondary circuit a maximum voltage in one sense fol-



Interior view of the radio chest showing the arrangement of the various parts

lowed by a maximum voltage in the other sense. This vibrating device is actuated by the magnetism created by the primary windings attracting and repelling a double electromagnet having opposite ends of the same polarity. The electromagnet, with the vibrator arm and contacts attached to it, is supported on a spring. The vibrator vibrates at a speed of 360 vibrations a second, the device being adjustable by means of set screws. A safety gap, mounted on the buzzer transformer, safeguards the insulation from punctures in the event that the spark gap becomes improperly adjusted.

The spark gap of this 50-watt quenched-spark radio-telegraph transmitter has three silver plates divorced by mica separators which are 0.005 of an inch thick. Sparking occurs at a uniform rate around the edges of these silver plates. The open design of gap permits the telegraph operator to observe the sparking device in operation and to note any irregularity in behavior of the spark across the separators. Then, too, a puncture of one of the latter is readily observed and the defective separator replaced with a new one. The spark gap is safeguarded from accidental short-circuiting by particles of dirt or drops of rain by a shield of a non-conducting material resembling celluloid. The telegraph key is shunted by a resistance of six ohms which permits sufficient electric current to pass so that the vibrator of the buzzer transformer retains its motion during the intervals between dots and dashes common to the international telegraph code. The contacts of the telegraph key are of silver, a metal having splendid spark-quenching properties.

The radio-telegraph receiving unit in this portable chest is inductively coupled, and the coupling may be varied. Three scales of wave lengths overlap, these being 100 to 200 meters, 150 to 300 meters, and 275 to 550 meters. A single control switch, governing inductance and capacity, changes both the primary and secondary from one scale to the other. Precise tuning is effected by a variable inductance in the primary and a variable condenser in the secondary circuits. The detector is a galena crystal, but other forms of detectors may be employed. The detector is mounted on the interior of the chest, with a control knob projecting from the wooden container for adjusting the strength of signal.

Various Types of Receiving Sets

By A. Reisner

A single coil, double-slide tuner with crystal detector, an old type of receiver which gives fair results. It is easy to construct and operate, and is a type of receiver frequently put together by novices

The two-circuit receiver, without regeneration, is extensively used by broadcast listeners. Like the single-circuit receiver it is light on upkeep and is easily adjusted and controlled

A modern type of regenerative single-circuit receiver, with a vacuum tube detector. This type of receiver is easy to operate and the maintenance cost is low. It has found favor with a large number of broadcast listeners

THE receiving sets which are at present offered to the public by the different manufacturers may be reduced to a few fundamental circuits, regardless of what trade names are applied to them. Any set which the novice is likely to build himself is also one of these few fundamental circuits. It is the object of the present article to explain in a simple way just what the chief receiving circuits are, how they operate, their advantages and disadvantages so that the novice, when he purchases a set or builds a set, will have some grounds on which to base an intelligent decision.

The Single Circuit Receiver

The simplest type of receiver and the oldest type in the history of radio communication, is the single circuit tuner. These single circuit tuners are at present made by a large number of manufacturers and in all cases practically, the circuit may be reduced to one of the three fundamental circuits shown in figure 1, 2, 3. Figure 1 is the circuit employing a simple single-layer coil which is tapped at different turns, these taps being brought to switch points. The wave length is varied by a switch which cuts in different amounts of the coil by moving over these switch points. Figure 2 is the circuit which employs only a variometer to tune to the required wave length. The variometer consists of one coil rotating inside another coil, both coils being connected in series. By rotating the inner coil the amount of inductance is varied. This adjustment is similar to moving the switch blade of figure 1 over the switch studs. There is one important difference. In the first circuit the wave length can only be varied in steps. Thus if there are 100 turns on the coil and the coil is tapped at every ten turns the wave length can only be varied by ten turns at a time, never less. The novice will understand therefore that he cannot get very fine adjustments in wave length. Of course he can tap the coil every 5 turns which will be a little better. The variometer, however, allows the wave length to be varied continuously from the lowest to the highest, since it varies continuously, not in steps, from the start to the end. With the variometer it is possible to get finer adjustment of the wave length. The circuit in figure 3 employs a fixed coil in series with a variable condenser. Here the wave length is varied by the condenser only, and since the capacity of a variable condenser varies continuously through its range the wave length may be finely adjusted.

From the foregoing the novice will see that he can get better wave length adjustments with the circuits in figures 2 and 3 than he can with that in figure 1. This means that he will also get less interference with these two circuits. Actually the dif-

ference is very small, though there is some difference. The last two circuits are better than the first, though for a starter the first will do very well. It is entirely a question of cost. If the amateur novice wants to build his sets he may well start with circuit 1, for he can build a tapped coil for a few cents and learn the ins and outs on it. When buying the set any of the above types will give good enough service during the initial period. If the difference in cost is not great it is advisable to buy the second or third type for better tuning.

This single circuit type here described may be used with any kind of detector, tube or crystal. The crystal will give very good reception for local work. The single tube is likewise really only good for local work, especially when the type of circuit here mentioned is used. It is suggested the novice begin with a crystal, since the cost is really very low, and after he has learned something about his set he can shift to a tube.

Figure 4 illustrates another type of single circuit receiver in which both a tapped inductance coil and a variable condenser are used. By this scheme it is possible to get just the right combination of inductance and capacity to give the best results. The exact advantage gained by this method over that of figure 3 is really very small, and as far as the beginner is concerned there is no advantage for him in using this circuit for the following important reason. The very great advantage which the circuits of figures 1, 2 and 3 have over all other circuits is that there is only one adjustment to make—only one knob to turn to get the results. In circuit 4 and all other circuits there are two—the tapped inductance and condenser in figure 4—and more knobs to turn. This makes tuning and adjusting more complicated. The single circuit tuner of figures 1, 2 and 3 with only one knob to turn, makes it by far the best receiver for the novice.

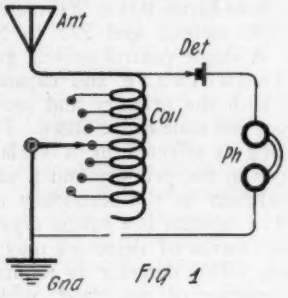


Fig 1

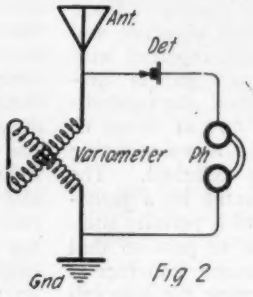


Fig 2

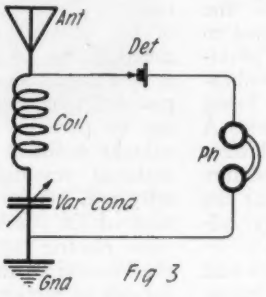


Fig 3

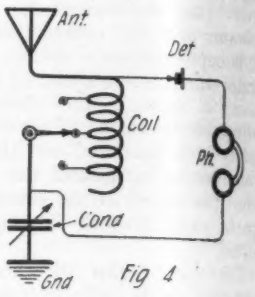


Fig 4

Single-circuit tuners

THE TWO-CIRCUIT TUNER

In the circuit just described the reader will observe that there is but one circuit, namely the antenna circuit. In the present receiver there are two circuits, one in the antenna, and the other connected to the detector. The circuit connections of the main type of receiver are shown in figure 5, which is the simplest type of two-circuit tuner. Some two-circuit tuners have still other parts, such as a condenser in the antenna, as in figure 6. The object of the condenser is to give better tuning. It will be observed that this tuner has a large number of adjustments to be made. The antenna circuit must be tuned to the received wave length by adjusting the inductance as in figure 5, and sometimes the inductance and condenser as in figure 6. Then the second circuit has to be adjusted to be tuned to the antenna, by varying the inductance and condenser.

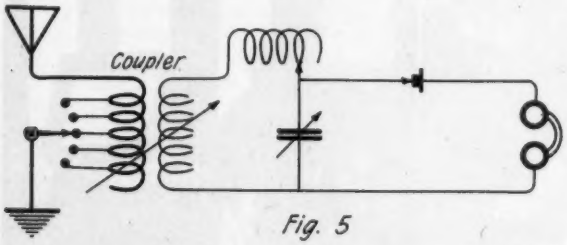


Fig. 5

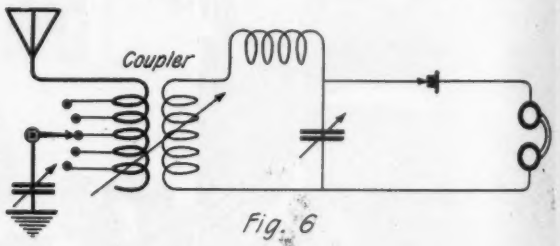


Fig. 6

Two-circuit tuners

Finally the two circuits have to be coupled to each other until the best results, as indicated by the best signal, with least interference, is secured. The two inductances make up the vario-coupler with which the coupling between the two circuits is adjusted. This type of receiver is used with any kind of a detector, crystal and tube. But if the novice has reached the stage where he can work these complicated adjustments, then he should use a vacuum tube as a detector.

The reader will see that this type of receiver is much more complicated to adjust than the single-circuit receiver. There are four or five times as many adjustments to make. The two-circuit tuner has one advantage over the single-circuit tuner, in that it will cut out some amount of interference. But as far as the signal strength in the telephones goes the single circuit tuner is just as good as the double circuit. The difference in cost may be considerable so that a choice depends upon how much the novice can spend. Otherwise they are much alike. This much may be said for the novice's guidance. If he is going to use the set with a vacuum tube he should at least purchase or make one of the type that can be easily changed to a regenerative set, as described later. For the cost of the latter is practically the same as the former and its results and efficiency are very much superior.

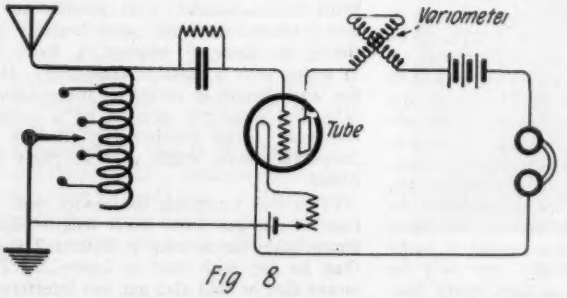


Fig 8

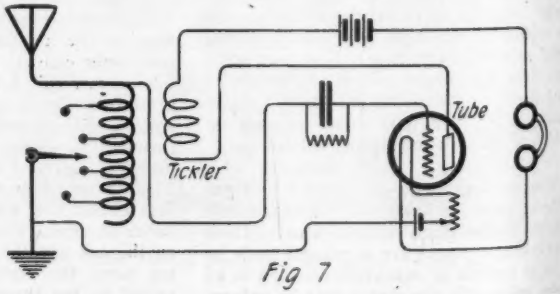
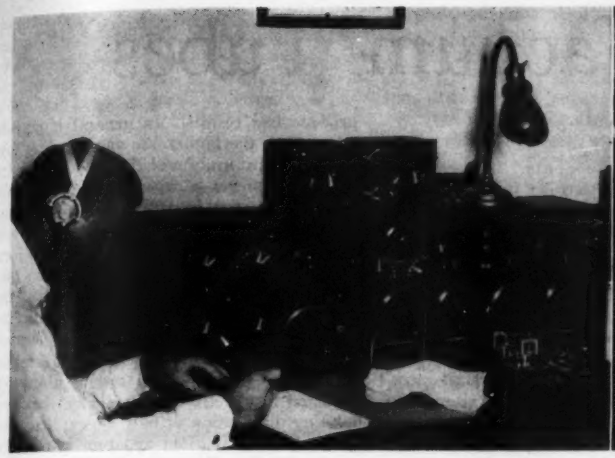


Fig 7

Single-circuit regenerative receivers



A complex, regenerative receiver, with three tuned circuits, employing variometers, extensively used by experienced amateurs. This type of receiver is more difficult to operate than those of the single-circuit type. It is highly selective and very efficient

Another type of single-circuit regenerative broadcast receiver which is extensively used by the radio public. It has a vacuum tube detector and two steps of audio frequency amplification, making it possible to operate a loud speaker, if desired

Where a crystal detector is used the writer believes from experience that the single circuit is best adapted to the novice's need.

THE SINGLE CIRCUIT REGENERATIVE RECEIVER

This type of receiver is a modification of those described in figures 1, 2, 3, 4. Only a vacuum tube detector may be employed with a regenerative receiver. Thus the cost of the regenerative set is greater. The usual type of circuit employed in most marketed single circuit regenerative receivers is shown in figures 7 and 8. It is seen that it has just an additional coil over that required by the single circuit non-regenerative sets. This coil in figure 7 is similar to the antenna coil, only its position is variable relative to the antenna coil. It is called the tickler coil. In figure 8 a variometer is used instead. Its position does not have to be varied. The same effect as varying the coil position of figure 7 is produced by the variation of the variometer inductance. It increases the loudness of the received signal. The adjustments of this type of single circuit receiver are the same as for those in figures 1, 2, 3, 4, except that here we have an additional adjustment, the tickler coil or the plate variometer to increase the loudness of our signals. The cost of the single-circuit regenerative set is very little more than the single circuit tube set. The adjustments of the regenerative set are practically the same as those for the non-regenerative set, except for the one tickler or variometer adjustment. But the results obtained with the regenerative set are far superior to those obtained with the non-regenerative set. First because the regenerative set amplifies, makes louder, the received signals. Second, because the regenerative set has a certain peculiar action which reduces the interference more than the non-regenerative set. So the comparison shows that in cost, ease of adjustment and operation the regenerative and non-regenerative are pretty much alike, but in results the regenerative set has the lead and a great lead at that. Thus for the novice who buys a tube set the single circuit regenerative set is preferable. Or if he buys a non-regenerative set he should see that he can change it to a regenerative set easily. If he builds his set it makes little difference, for the cost will be the same and he can always add a tickler or a plate variometer to change it to a regenerative set.

The single circuit regenerative set is also much better than the two circuit non-regenerative set described under B. First, because there are very much fewer adjustments to make, therefore the novice will have less difficulty in operating it and getting results; second, because the single circuit regenerative receiver gives much louder signals, and third, because as far as interference goes the single circuit regenerative is as good, if not better than the two circuit non-regenerative. Also the novice will find that the single circuit regenerative will prove less expensive for him than the two circuit non-regenerative receiver. The single circuit regenerative receiver has much to commend it for its simplicity, and results.

TWO-CIRCUIT REGENERATIVE RECEIVER

Of the standard simpler circuits this type is the costliest, most complex as far as operation goes, and the best as far as results go. The novice will see that it is difficult to get all the good virtues such as low cost, ease of operation and best results into one receiver. The circuit is shown in figures 9 and 10—two main types, figure 9 having a tickler coil like that in figure 7, while figure 10 has the variometer like that in figure 8. The novice will see that this last type of receiver is really a combination of the simple two-circuit non-regenerative receiver of figure 5 with the regenerative principle. Therefore this receiver has all the adjustments of the two-circuit receiver of figure 5, together with the additional adjustment of the regenerative receiver, namely the tickler or the variometer. But in this type of receiver the adjustments are more sensitive and require greater care than in either of the types in B or C. Thus the first thing we find out is that the adjustments here are more complex than in any of the foregoing. Second, this type of receiver is also the costliest of them all. Third, it gives by far the most superior results. It gives loudest signals and least interference. For the novice who has passed the first few stages this is the best receiver for him.

To actually give rules as to which receiver any newcomer in radio should buy is impossible. The man who builds his own will in all likelihood be able to choose easily and he will build until he finds the one he likes best. For the totally inexperienced novice it is advisable to start with an inexpensive single circuit crystal set of standard make. It is hoped that these simple statements and comparisons of the merits of each type of set will help those who are somewhat bewildered.

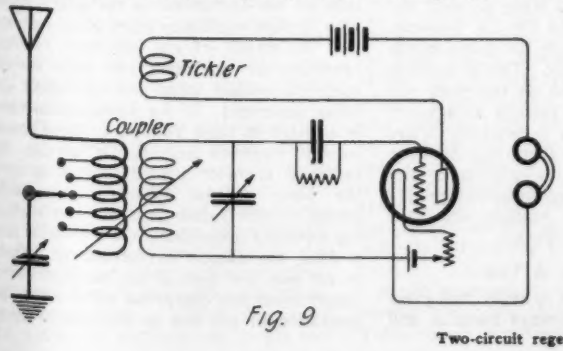


Fig. 9

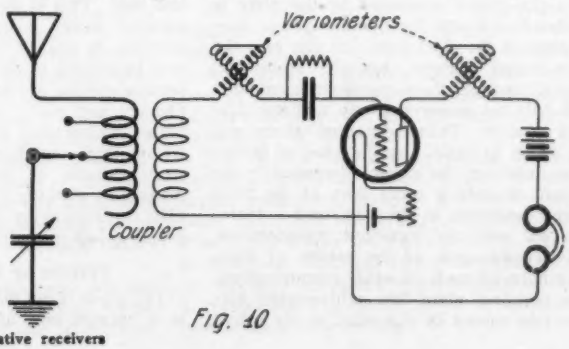


Fig. 10

Two-circuit regenerative receivers

Notes On Vacuum Tubes

By M. L. Snyder

TO secure a certain power output from a given vacuum tube requires a certain electron emission from the filament. This electron emission is secured in vacuum tubes by heating the filament. The emission then depends upon the power expended in the filament, the size of the filament, and the material of the filament.

Types of Filaments

There are two main types of filaments as generally used in practice: (1) the tungsten filament, and (2) the oxide-coated filament. It is interesting to consider the relative advantages of each. The former is made of pure tungsten metal, while the latter is made of thin platinum strip wire coated with an oxide of barium or strontium or some other element of the same family. These two types of filament differ markedly in their power of emitting electrons. The tungsten filament requires heating to a white heat before emitting electrons appreciably. Heating to a red heat will produce practically no emission at all. The oxide-coated filament, on the other hand, requires heating just to a cherry-red heat to produce its rated electron emission. Thus for any given power of a tube the tungsten filament consumes about twice as much power as the oxide-coated filament for the same electron emission.

This fact leads to some interesting conclusions. Where the question of power supply and cost is of first importance the above must be taken into careful consideration. Thus in the case of detector or amplifier tubes the power consumed in the plate is practically nil and the filament power consumption is the chief item. In this case the oxide-coated filament has the advantage, since it produces the same electron emission with half the power that the tungsten filament requires. Thus the storage battery will last twice as long. In the case of power tubes, however, the energy consumed in the filament is only a small part of the total energy consumed in the tube, and is therefore not such an important consideration, and a comparison of the merits of these tubes must be made on other considerations.

In the first place the oxide-coated filament tube cannot be evacuated to the extent that the tungsten tube can. In order to thoroughly evacuate a tube it is necessary to heat the filament to white heat so that occluded gases will be given off and pumped out. In the same way the plate of the tube must be bombarded to a white heat. This is capable of being done with a tungsten tube since tungsten is supposed to be worked that way. However the oxide-coated tubes cannot be burned brighter than a dull red heat without endangering the life of the filament, and care should be taken not to attempt to burn the tube at the same brilliancy as the tungsten filament. The presence of gas thus often results in erratic operation and certainly is a bar to the success of the oxide-coated filament tube as a generator of oscillations, since high vacuum is essential for this purpose. Furthermore, even though the oxide-coated filament requires much less current for the same electron emission than the tungsten filament, due to the poor vacuum in the former, the life of the oxide-coated filament is frequently less than the tungsten. This is due to the ionization of the gases which are present in oxide-coated tubes, for when ionization results, the excessive increases in plate current thus caused, inevitably result in burnt out filaments. In the matter of gases which may be present in tubes the tungsten tube has a great advantage. It is a well known fact that the vacuum of a tungsten filament tube increases, that is, becomes better, with time and use. This is due to some peculiar absorptive power possessed by the filament, whereby it absorbs slowly the gases which may be present in the tube. This is possible because during evacuation on the pump the filament and plates are worked at a much higher temperature than in practice. Thus we see that even though there may be some gases present in the tungsten tube, the manner of working at high temperatures results in improving the vacuum and thus avoiding bad ionization effects.

Effects of Gas in Tubes

The above is not meant to imply that gases in a vacuum tube are always harmful and produce bad results. In general it may be stated that the higher the vacuum in a tube the more uniformly will the tube behave. A true electron relay depends solely upon the flow of electrons from filament to plate and this flow depends solely upon the current through the filament. For steady, uniform operation of amplifiers and oscillation generators, it is absolutely essential that this true electron relay action be present, undisturbed by any gases which may be present. The presence of gases in a tube results in ionizing effects which cannot always be repeated in exactly the same way, thus prohibiting duplication of uniform results. This ionizing effect is often apparent in the form of the familiar "blue glow." When the filament current or the plate voltage is gradually increased, a point is reached when the flow of electrons, impinging upon the gas molecules, ionize the gas and a blue glow is seen in the tube. This invariably results in an erratic increase of current which at once destroys the previous uniform action of the tube.

In the case of the detector or amplifier tube this ionization may or may not result in harm to the tube. Most often it does not, and when the plate voltage or filament current is increased the tube behaves properly as it did just before ionization took place. At times it may happen that the excessive plate current resulting from the gaseous ionization will destroy the filament. In the case of oscillator tubes it may safely be said that gaseous ionization almost invariably results in the destruction of the tube. Those who operate oscillation tubes know only too well the effects of gas ionization. During operation of the tubes the plate current reads its normal value and oscillations are being generated. If for some reason there is a surge in plate voltage, or the filament current increases and gas is present, the radiation ammeter suddenly drops to zero, the plate current ammeter immediately jumps to high values as in the non-oscillating state and immediately the oscillation tube is dark, the filament has burned out. There is no use for gas in an oscillator tube. Apart from this disastrous effect which the ionization of gas has on the tube, it alters

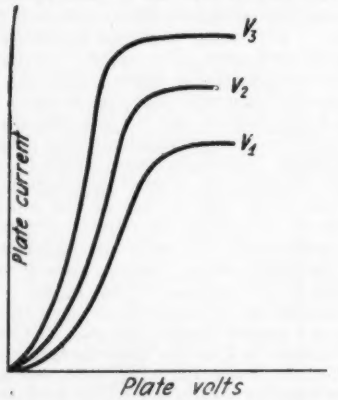


Figure 1

Regular plate curves of gas free tubes

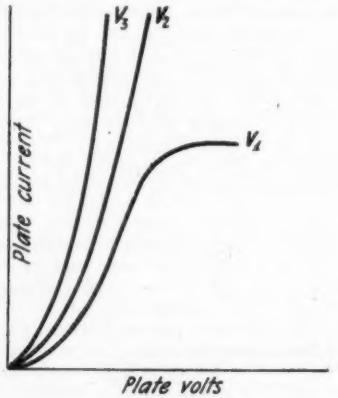


Figure 2-a

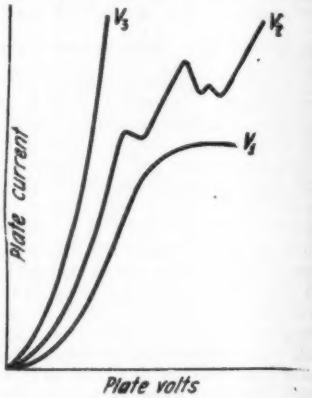


Figure 2-b

Plate curves showing the disturbing action of different proportions of gas in tubes

the characteristics of a tube. The characteristics of a tube at filament currents and plate voltage at which gas does not show its effects are entirely different from those when the gas does display its effect. A variable characteristic for a tube is not at all conducive to uniform operation. If properly controlled by expert operators the presence of a little gas in a detector tube may prove very beneficial to the tube.

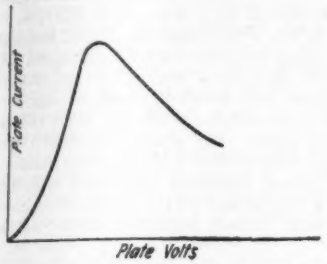


Figure 3—Plate curve of a partly filled gas tube

An interesting manifestation of the presence of gases in tubes, which many amateurs may have observed, but could not explain, is the following. The writer in some work with experimental tubes would apply the filament current to the tungsten filament and expect immediately to see the filament at white heat. Once or twice it occurred that, with the rated current through the filament, the current seemed barely to heat the filament, for just a faint red heat would be observed. Examination proved that those tubes in which this phenomenon occurred invariably had gas. The reason that the current did not heat the filament to incandescence was that gas is a very good heat conductor and no sooner was the filament heated than the gas would immediately conduct the heat away from the filament and thus prevent it from heating to incandescence. Amateurs would do well to note this, for this is a positive sign of the presence of gases.

The presence of gas may also be detected by means of characteristic curves of tubes. A tube in which there is extremely minute amounts of gas which do not make their presence felt, will always give regular characteristic curves as shown in figure 1. If gas is present in disturbing amounts then the plate currents will rise to enormous values for increasing plate voltages, as shown in figure 2 (a) or the plate current will take on erratic values, as in figure 2 (b). Figure 3 illustrates well the variable peculiarities of tubes filled with some gas. This characteristic curve taken on a small tube showed a falling characteristic beyond a certain voltage. With this falling characteristic, which is similar to that of the arc, oscillations could be produced in the same way as with the arc. Experiment verified this interesting theory.

The reason for this remarkable sensitivity of gas filled detector tubes is shown clearly by the characteristic curve of one tube which was filled with just a certain amount. This curve is given in figure 4, and shows at one point a very definite hump. Measurements show that the extreme sensitivity of this tube occurs at operating conditions corresponding to those which produce this hump, which at once explains why it requires pretty careful and expert manipulation to get best results out of the gas filled tubes. The novice would not be able to get best results out of this tube, whereas he would be able to get pretty good results out of the high vacuum tube. For the novice the high vacuum tube is then the best thing. When all is said and done on this subject of gas in tubes, experience shows that even for the expert, and especially for all-around work the well evacuated tube is the very best, for what with efficient circuits and the amplification produced by well evacuated tubes, the extra sensitivity of the gas filled detector is more than equaled.

Tube Factors Influencing Amplification of Tube

The amplifying properties of a tube are dependent upon the dimensions and spacing of the elements within the tube. We have then the interesting case of an electrical factor which is determined entirely by the mechanical design of the elements. We have in an amplifying tube a flow of electrons from a filament to a plate, and between plate and filament in the path of the electrons is a grid. A voltage applied to this grid controls this flow of electrons from filament to plate. The greater this control of the grid is the greater will be the amplifying properties of the tube. For the greater this control is the smaller will be the voltage necessary for the grid to produce a certain change. Now we can easily see some of the factors which influence the control of the grid over the flow of electrons. In the first place if the grid has a few wires widely spaced the electrons have a much better chance of escaping to the plate through the meshes than if the wires were very closely spaced. Thus the first factor is the spacing of the grid wires. The more closely they are spaced the greater is the amplification. Secondly, a mathematical analysis shows that the finer the grid wires are the greater will the amplification of the tube be. Thirdly we have to consider the size of the entire grid. If the length of the filament is greater than the length of the grid it will be evident that the electrons emitted from the ends of the filament will not be under the control of the grid since the grid does not extend out that far. This results in lowering the amplification due to incomplete control. Even if the grid were exactly the same length as the filament the control would be incomplete, since the electrons from the ends of the filament will be able to bend around the ends of the grid, and thus not be subjected to grid control. In order, then, that the electrons be completely under the control of the grid the grid must completely enclose the filament, that is, be larger than the filament, and in this way the amplification of the tube will be greater than otherwise. Finally we have the spacing of the elements. There seems to be a common impression among amateurs that the amplification depends upon the distance of the grid and plate from the filament. This is an erroneous notion. The distance of the grid or plate from the filament, strange to say, has no bearing on the amplification of the tube. There is only one distance that counts and that is the distance of the plate from the grid. The greater this distance is the greater will the tube amplification be, the less this distance the less is the tube amplification.

In the mounting of vacuum tubes one important precaution should always be taken. Tubes should wherever possible be mounted vertically. If mounted horizontally there is always great danger of the filament falling on grid and plate and ruining the tube. When the filament is hot it sags considerably. If the tube is mounted vertically there is less tendency to sag toward the grid and plate than when it is mounted horizontally. Many tubes are destroyed because of wrong mounting and it pays to give proper consideration to this part of the operation of a tube so that replacements may be reduced.

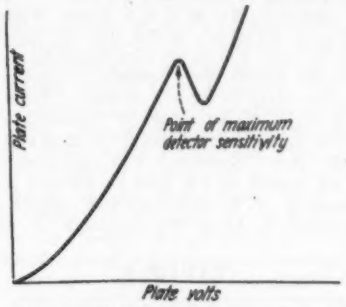
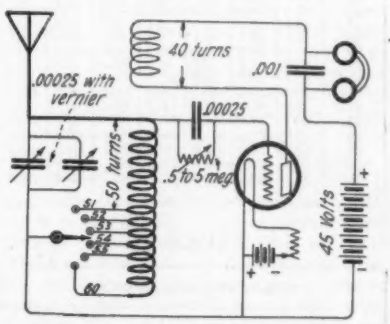


Figure 4—Characteristic plate curve of a gas filled detector tube

A Groundless Receiver

JOHN W. McGRATH has developed a single-circuit regenerative receiver that can be easily assembled by vacationing enthusiasts, that gives excellent results. An antenna only is required. The set as made up by Mr. McGrath is mounted on a 6 x 7-inch panel and is very compact. Both A and B batteries are carried in the box, and there is also room for 90 feet of No. 18 bell wire,



Single-circuit regenerative receiver that works well on an antenna without a ground connection

to use as an antenna, as well as a Dubilier light socket attachment, the latter to be used, if desired, in place of the antenna.

Mr. McGrath has had trouble on previous vacations of finding a suitable ground and the present set was developed to operate without one. With this set he has frequently heard broadcasting stations 1,000 or more miles distant and the regular daylight range is 250 miles.

The receiver is tuned by means of the variable condenser, or by means of the tapped inductance, or by a combination of both. Excellent results have been obtained when using a wire fence and also iron pipes as antennas. Mr. McGrath states that this set has been connected to an antenna while a crystal set was operating on it, without interference between them.

Practical Tables for Inductance and Coil Calculations

By A. Reisner

INDUCTANCE coils are built with wire ranging in diameter from No. 14 B & S gauge to No. 40 B & S gauge, depending upon the nature of the coil, the current it is to carry and so on. In designing such coils, no matter what formula is employed it is necessary to know a number of factors, such as its diameter bare or insulated, the number of turns it will wind per inch or per square inch. Sometimes coils are designed by the weight of the wire on the coil, and frequently it is desirable, and sometimes necessary, to know the resistance of any given weight or length of the wire on the coil. The writer has therefore compiled the following four tables which give all the data generally required in the design of inductance or any other kind of coils. These tables have been gotten up for all sizes of wire generally used in practical work, and with all the various types of insulation which may possibly arise.

Table I gives the turns per linear inch of different sizes of wire with the various types of insulation, while Table II gives the turns per square inch. These two factors are quite important in all inductance design work, the latter being important particularly when designing square section coils. In examining these tables the very interesting point will be observed that the winding per linear inch and per square inch is the same for DSC wire as for SCC wire. This is verified by Table III which gives the outside diameters of the various sizes of wires when covered by the various types of insulation, and it will be observed that the diameter of SCC wire is identical with the diameter of DSC wire for almost all sizes of wires excepting the larger ones. Hence in designing coils requiring the definite number of turns per linear or square inch shown under these two insulation headings, the designer has a certain latitude, since he may choose either type of insulated wire without altering the requisite winding. Table IV gives the balance of miscellaneous information about these sizes of wires, such as the weight per 1,000 feet, resistance per pound, and pounds per ohm of resistance.

The use of these tables is of course obvious to the amateur. If his inductance formula shows that he requires say a total of 102 turns of wire closely wound on 5 inches of tube, this gives him a winding of 20.4 turns per linear inch. Examination of Table I shows that No. 18 DCC wire winds 20.3 turns per inch, No. 17 SCC and No. 17 DSC both wind 20 turns per inch. No. 17 enamel and SSC winds 20.5 turns per inch. The first and last of these possibilities are the nearest to his requirements, while the other two are quite close. His choice will depend upon what wire he has available or to conditions of voltage insulation which have to be met. In a similar way all the other tables are employed. These reference tables will be found to be very handy for the amateur and it is suggested that they be copied or cut out and filed in his note book or data book.

TABLE I

TURNS PER LINEAR INCH

Gauge Wire B. & S.	Kind of Insulation					Enamel	
	DCC	SCC	DSC	SSC	Enamel	And SCC	And SSC
14	13.7	14.6	14.7	15.0	15 2	14.2	14.7
15	15.0	16.2	16.4	17.0	17.0	15.8	16.5
16	16.7	18.0	18.2	19.0	18.7	17.6	18.4
17	18.5	20.0	20.0	21.2	21.4	19.5	20.5
18	20.3	22.3	22.3	23.6	24.0	21.7	22.9
19	22.5	25.0	25.2	27.0	27.2	24.2	25.8
20	24.5	27.5	27.5	29.5	30.1	26.5	28.4
21	27.5	30.8	30.8	32.8	33.6	29.6	31.5
22	30.0	34.0	34.0	36.6	37.7	32.7	35.0
23	32.7	37.5	37.5	40.7	42.3	36.1	39.0
24	35.5	41.5	41.5	45.3	47.2	39.7	43.1
25	38.5	45.7	45.7	50.3	52.9	43.7	47.9
26	41.8	50.2	50.2	55.7	59.0	47.8	52.8
27	45.0	55.0	55.0	61.7	65.8	52 1	58.1
28	48.5	60.0	60.0	68 3	73.9	57.0	64.4
29	52.0	65.5	65.5	75.4	82.2	61.9	70.6
30	55.5	71.3	71.3	83.1	92.3	67.4	77.9
31	60.0	77.3	77.3	91.6	103.0	72.8	85.3
32	62.7	83.7	83.7	101.0	116.0	79.1	93.9
33	66.3	90.3	90.3	110.0	130.0	85.6	103.0
34	70.0	97.0	97.0	120.0	145.0	91.7	112.0
35	73.4	104.0	104.0	131.0	164.0	98.8	123.0
36	77.0	111.0	111.0	143.0	182.0	105.0	133.0
37	80.3	126.0	126.0	155.0	206.0	113.0	146.0
38	83.5	133.0	133.0	168.0	235.0	120.0	157.0
39	89.7	140.0	140.0	181.0	261.0	128.0	172.0

TABLE II

TURNS PER SQUARE INCH

Gauge Wire B. & S.	Kind of Insulation					Enamel	
	DCC	SCC	DSC	SSC	Enamel	And SCC	And SSC
14	187	213	215	229	240	201	216
15	229	264	265	287	290	250	271
16	280	327	330	360	350	309	338
17	340	404	410	450	458	381	421
18	410	500	510	560	575	469	524
19	510	630	645	715	740	587	665
20	598	750	770	865	905	701	805
21	750	950	950	1080	1120	878	990
22	890	1160	1160	1335	1420	1071	1227
23	1070	1416	1416	1655	1785	1306	1518
24	1265	1722	1722	2050	2225	1575	1858
25	1490	2085	2085	2525	2800	1907	2289
26	1745	2515	2515	3110	3484	2281	2788
27	2030	3019	3019	3810	4328	2713	3381
28	2345	3611	3611	4666	5451	3250	4141
29	2695	4295	4295	5688	6781	3830	4988
30	3075	5080	5080	6910	8527	4545	6075
31	3490	5980	5980	8390	10568	5305	7267
32	3930	7000	7000	10101	13365	6250	8815
33	4400	8145	8145	12130	16950	7325	10672
34	4885	9405	9405	14500	20967	8403	12910
35	5390	10817	10817	17250	26745	9766	15185
36	5917	12346	12346	20410	33051	11080	17775
37	6450	13995	13995	24015	40766	12755	21295
38	6978	15765	15765	28106	34990	14290	24685
39	7525	17630	17630	32690	68120	16310	29410

TABLE III

Gauge Wire B. & S.	Diameter In Inches Of							
	Bare Wire	Enamel	SCC	DCC	SSC	DSC	Enamel and SCC	Enamel and SSC
14	0.0641	0.0658	0.0691	0.0736	0.0661	0.0681	0.0713	0.0678
15	0.0571	0.0587	0.0621	0.0666	0.0591	0.0611	0.0642	0.0607
16	0.0508	0.0523	0.0558	0.0603	0.0528	0.0548	0.0573	0.0543
17	0.0453	0.0467	0.0503	0.0548	0.0473	0.0493	0.0517	0.0487
18	0.0403	0.0417	0.0453	0.0498	0.0423	0.0443	0.0467	0.0437
19	0.0359	0.0372	0.0409	0.0454	0.0379	0.0399	0.0422	0.0392
20	0.0320	0.0333	0.0365	0.0410	0.0340	0.0360	0.0378	0.0353
21	0.0285	0.0298	0.0330	0.0375	0.0305	0.0325	0.0343	0.0318
22	0.0253	0.0265	0.0298	0.0343	0.0273	0.0293	0.0310	0.0285
23	0.0236	0.0238	0.0266	0.0306	0.0246	0.0266	0.0278	0.0256
24	0.0201	0.0212	0.0241	0.0281	0.0221	0.0241	0.0252	0.0232
25	0.0179	0.0190	0.0219	0.0259	0.0199	0.0219	0.0232	0.0210
26	0.0159	0.0169	0.0199	0.0239	0.0179	0.0199	0.0209	0.0189
27	0.0142	0.0152	0.0182	0.0222	0.0162	0.0182	0.0192	0.0172
28	0.0126	0.0135	0.0166	0.0206	0.0146	0.0166	0.0175	0.0155
29	0.0113	0.0122	0.0153	0.0193	0.0133	0.0153	0.0162	0.0142
30	0.0100	0.0108	0.0140	0.0180	0.0120	0.0140	0.0148	0.0128
31	0.0089	0.0097	0.0129	0.0169	0.0109	0.0129	0.0137	0.0117
32	0.0071	0.0087	0.0120	0.0160	0.0100	0.0120	0.0127	0.0107
33	0.0063	0.0077	0.0111	0.0151	0.0091	0.0111	0.0117	0.0097
34	0.0056	0.0069	0.0103	0.0143	0.0083	0.0103	0.0109	0.0089
35	0.0050	0.0061	0.0096	0.0136	0.0076	0.0096	0.0101	0.0081
36	0.0045	0.0055	0.0090	0.0130	0.0070	0.0090	0.0095	0.0075
37	0.0040	0.0049	0.0085	0.0125	0.0065	0.0085	0.0089	0.0069
38	0.0035	0.0044	0.0080	0.0120	0.0060	0.0080	0.0084	0.0064
39	0.0031	0.0039	0.0075	0.0115	0.0055	0.0075	0.0079	0.0059

TABLE IV

Gauge Wire B. & S.	Weight Bare Wire Per 1000 Ft.	Ohms Per Lb.	Pounds Per Ohm
14	12.60	0.126	4.98
15	10.00	0.201	3.15
16	7.94	0.318	1.99
17	6.26	0.505	1.24
18	4.96	0.808	0.776
19	3.95	1.28	0.490
20	3.14	2.04	0.320
21	2.49	3.24	0.194
22	1.98	5.14	0.123
23	1.56	8.17	0.073
24	1.24	13.00	0.048
25	0.99	20.6	0.031
26	0.783	32.7	0.019
27	0.621	52.1	0.012
28	0.493	82.7	0.007
29	0.391	132.0	0.005
30	0.311	209.0	0.003
31	0.246	332.0	0.002
32	0.196	526.0	0.001
33	0.155	836.0	0.0007
34	0.123	1332.0	0.0005
35	0.098	2110.0	0.0003
36	0.078	3350.0	0.0002
37	0.062	5300.0	0.0001
38	0.049	8430.0	0.00008
39	0.039	13450.0	0.00005

Shielding of Receivers

By M. Wolf

THE subject of shielding has undoubtedly come to the attention of most radio fans. They have been advised to shield their panels to avoid body capacity effects, or they have been told to shield their transformers to reduce magnetic coupling between stages. Very little has been written at all on this subject and there is need for some simple explanations as to the need for shielding, and what shielding accomplishes. It is the object of this article, therefore, to explain some of these things briefly.

There are two types of effects which have to be guarded against by means of shielding. These are first, electrostatic effects, second, magnetic effects. Let us take these up in order. Any live conductor is at a certain electric potential and is said to be charged electrically. According to electrical theory there are electrostatic lines of force either coming from, or going to, this conductor. If it is positively charged the lines of force may be considered as coming out of the conductor, if it is negatively charged the lines of force may be considered as going to the conductor. Since positive and negative are relative terms, anyhow, we may simply consider the electric lines of force as coming from the conductor (see figure 1). The number of lines of force which thus emanate from this conductor depend entirely upon how strongly the conductor is charged, i. e., its potential. The greater the potential the greater the number of lines of force, and so on. These lines of force stretch out all around the conductor and consequently may come in contact with, or lodge upon, other conductors in its vicinity. If that is the case it is an experimental fact that this body becomes charged with electricity by a process called "electrostatic induction" (see figure 2).

If the potential of the original conductor undergoes various changes for some reason, as when it is subject to the flow of an alternating current through it, the charge on it will vary in the same manner and hence the lines of force which radiate from it will likewise change. Consequently the charge of electricity induced on bodies in the electric field of conductor A (see figure 2), will vary correspondingly, and the changes which were produced on conductor A will be reproduced to a certain extent on the other conductors.

From this we can immediately learn that the different conducting parts in a radio set will influence each other by their electrostatic effect on one another. Variations in one conductor will produce variations in other conductors even though they are apparently moved away from each other. In this way unforeseen coupling effects are produced which cause considerable trouble such as production of undesired oscillations.

Now such effects can also be produced by such apparently trivial things as the movement of the hand near a knob of a sensitive set. What has happened here is that the motion of the hand towards the knob has introduced a small capacity in the set, namely the capacity of the person's body. This small capacity is sufficient to disturb the conditions to such an extent as to produce changes in other parts of the circuit. If, instead of altering the potential conditions on A (see figure 2) we alter its capacity, we have introduced a change in the conditions of the electric field surrounding A, therefore this change alters the electric field which is then transmitted to the body B. In the same way although the currents were flowing normally in the set before the hand was moved up to it, the mere addition of the small body capacity to the set was enough to alter the electric field to such an extent that the disturbance was transmitted to other parts of the circuit and oscillations were set up. This transference of disturbance is really equivalent to electrostatic coupling.

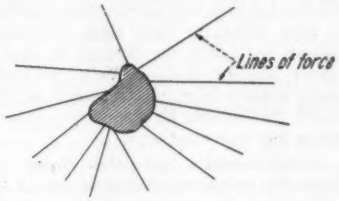


Figure 1

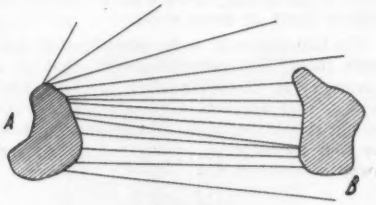


Figure 2

An electrically charged body and its electrostatic inductive effect upon a conductor

A much more obvious case is the one where the operator wears a pair of telephones and then tries to tune a circuit. Here his body capacity is connected, by means of the telephones on his head, to the plate circuit and his body capacity is also connected to other parts of the circuit by his hand tuning a condenser, for example. As a result coupling is produced which results in effects only too well known.

How can these effects be avoided? Suppose it were possible to keep the potential or electrostatic conditions of A and B (see Figure 2) always the same regardless of whether we moved near them or not, or regardless of whether we wore telephones or not. In this case no changes would occur due to the effect of one on the other and hence no undesirable effects would be produced. This is exactly what shielding accomplishes. Suppose a copper sheet is placed in back of the panel. Then any changes which take place due to the motion of the body near the set, for example, will be immediately reflected in changes in the electric condition of the copper sheet first since it is nearest the body. If we then connect this copper sheet to ground the current changes produced in it on account of capacity effects will be run to earth where they have no effect. Similarly if we shield with a metal case any transformer any changes which take place in the set due to capacity effects of the body will be reflected first in the electrical condition of the metal shield and by grounding this shield the induced currents will be run to earth where again they have no effect. Before the changes have a chance to penetrate inside of the transformer, thus producing undesirable coupling, they are run to earth by the shield surrounding the transformer. In the same way if telephone cords are shielded and grounded, protection is again secured. Any changes occurring in the electrical condition of the circuit due to such things as tuning with the hand will reach over into the plate circuit. But they will first take place in the shield on the phone cords and not affect the other parts of the circuit, since these induced currents which produce the trouble are run to earth through the grounded shields. Since the earth is always at the same potential any body which is connected to it will also be at that same potential. Hence no matter what changes take place, if the shields are grounded no serious coupling effects can be produced since the shields are always at the same potential as the earth. Thus by properly shielding a set and the different parts of a set and grounding the shields, protection is afforded against unforeseen couplings. The lower the resistance of the shields the better the protection, thus copper sheet is best. Also the less openings there are in any shield the better the results. For electric lines of force are able to get into the shielded apparatus through holes, cracks and other openings in the shields.

Now the case of magnetic shielding is practically the same, though here the shielding is more difficult. When a current flows through a coil, magnetic lines of force spread out around it. If these lines of force link another coil there will be an induced voltage in this coil which means that coupling has been established between them and the regular coupling effects are produced, such as feed back, etc. As far as radio frequency coils are concerned we cannot shield them from each other very well. But when it comes to the coupling which is produced between audio frequency transformers the case is easier. One of the important features about magnetic lines of force is that they prefer to travel through iron. Given two paths they will choose the nearest iron path, because this iron path offers less resistance to their flow. Each audio frequency transformer has magnetic lines of force leaving it. Not very many, to be sure, because the cores of these transformers are closed cores and the lines of force are concentrated in them. However, there are some that always leak out and travel to other circuits and thus produce undesirable coupling effects. If now we encase each audio frequency transformer in an iron case we will have an iron path. Any magnetic lines

of force which reach it from another circuit will travel through this iron case rather than penetrate through the iron case, then through the air between case and transformer, and then through the transformer. In other words, the iron shield here invites the magnetic lines of force from other circuits to flow through it, and by so doing prevents them from flowing through its transformer which it is shielding. Thus coupling effects between audio frequency transformers are eliminated.

If we now ground this iron shield we will be killing two birds with one stone. For with the iron shield we protect the transformer against magnetic fields and magnetic couplings with other parts of the circuit, and by grounding the shield we protect the transformer from electric fields and electrostatic coupling with other parts of the circuit.

Qualities of a Good Receiver

By S. GORDON TAYLOR

SO much is heard about DX work these days that many fans judge a set entirely by its ability to pick up distant stations. Under certain conditions this practice is natural, but in general it is being overdone. A friend of mine, for instance will not have a set in the house unless it will bring in broadcasting stations at least a thousand miles distant on a single tube. This, however, is one of the cases where this serves as a good basis of judgment because he is the only one who ever uses the set in his house.

On the other hand the majority of outfits today are used not only by the owner, but by all the members of his family. To the owner DX work is fascinating in most cases, of that there can be no question. But how about the family? Distance work has little interest for them. What they enjoy are the local broadcast programs. They like good volume and clear tone. The ideal set, therefore, is one that meets the requirements, not for DX work alone, but for volume and clarity as well.

Unfortunately these three qualities are not as a rule all present in one set. As is the case with all other rules, this one is subject to exceptions, but the owner of a set that meets all three requirements is indeed fortunate. In most cases the fan will have to be satisfied with one, or at the most, two of these qualities. The question, then, is which are the most important.

If the receiver is intended only for the pleasure of the owner, then one good for DX is probably the best because he is ever ready to pardon a lack of tone quality, or even lack of volume, provided he can tune in on Fort Worth, Havana and the rest of the distant points that constitute the amateurs' "Happy Hunting Grounds." If the family, or his non-radio friends are to enjoy his outfit, however, clearness and volume, should be the main considerations in its selection.

Clearness and volume are not so easy to judge as DX. If your set has these qualities, however, you will soon know it from the expressions of your friends when they hear it in operation. You may be so used to the set that you cannot well judge these qualities. Not so your friends. If you let them listen to Havana they will be mildly impressed; will speak of the wonders of science, etc. But let them hear a local station come in with bell-like clearness, with music and speech undistorted and they will praise without stint. If you feel that your friends do not properly appreciate your set, the chances are that there is considerable room for improvement either in its volume or its reproduction of music and voice.

As for clarity, perhaps the best test is comparison with the tone of the detector alone. Listen in on the first tube and then switch to the first stage of audio amplification. If there is a marked falling off in quality, there is room for improvement. If the quality is as good on one stage, switch to two stages. If the good quality of the detector is still present, then your set is an excellent one so far as tone is concerned.

The test for volume is perhaps the hardest of all. On detector alone the volume is not important, because it is necessary to use the headphones for satisfactory results. It is only necessary that there be sufficient volume to enable the listener to hear distinctly without strain. With one stage of audio amplification, music should be clearly heard throughout an ordinary room, even above low conversation.

Announcements and other voice signals from the broadcasting station should be reproduced with sufficient volume to equal the volume of the voice of a person in the room engaged in moderately loud conversation. This is providing a high power station is within thirty or forty miles.

On two stages of audio amplification, volume should be comparable with that of a phonograph. Using a horn of some kind with a loud speaker phone unit, speech and music should be easily distinguishable three or four rooms away, or say a hundred feet away in a direct line.

Mountain Peaks Support Giant Antenna

THE summit of the Herzogstand Mountain, south of Munich, Bavaria (Germany), is being used for the construction of a huge wireless station which will lift the antennas higher than those of the Eiffel Tower or Nauen, Germany's present trans-Atlantic station.

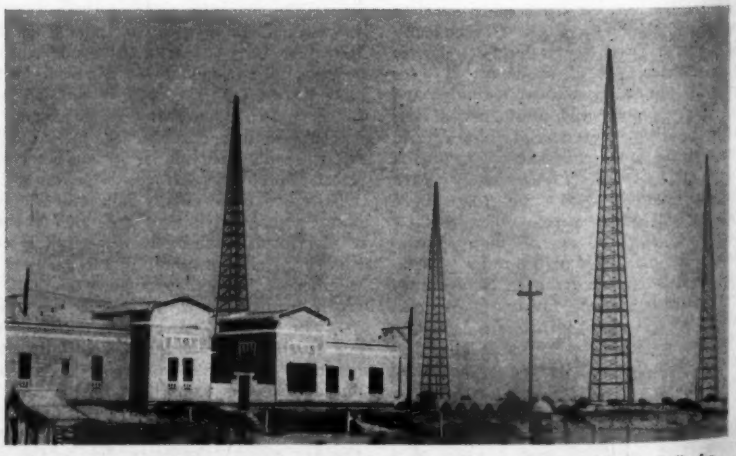
Herzogstand Mountain is 6,000 feet above sea level and on the other side of a narrow valley is another peak nearly as high. By stretching a wire cable between these two peaks the costly construction of steel towers is avoided and the damp valley gives every possible advantage for the reception or dispatching of radio waves. In addition the enormous electrical energy required to operate a station of this magnitude will be developed from water power.

Because of the great height and the length of the wire cable an ingenious arrangement is used by which the ends of the cable are attached to counterweights so as to compensate the wind pressure. The peaks are easily accessible from one side, but the sides which face the valley are almost perpendicular, which makes the location an ideal one for the experiment.

Two wave lengths will be used. A comparatively short one will be used in communicating with nearby points, but with the longer one it is hoped to reach places hitherto out of the radius of the greatest wireless plants in the world.

The work, which was started last Fall but which was stopped because of the long Alpine winter, is again well under way and it is expected the station will be completed this Summer.

Spain's High Power Radio Station



Government-controlled radio station at Cadiz, Spain. The station is used principally for communicating with other countries

NEW APPLIANCES AND DEVICES

The New Victophone

THE latest Rhamstine product, the new Victophone, meets a need for a loud speaking receiver that can be attached to the tone-arm of the phonograph. It may also be attached to any type of amplifying horn, but the especial intent was to make possible a wider use of the phonograph, and remove the necessity of additional expense incident to the purchase of an additional horn. The tone qualities of the phonograph produced in the wooden amplifying chamber are rendered even more pleasing by the

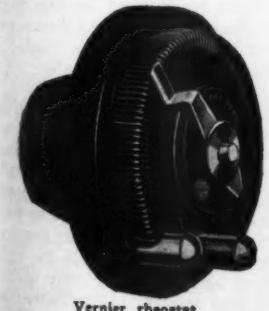
The Victophone

Victophone which reduces metallic vibration by means of the rubber gasket between the tone-arm flange and the cap.

Installation is made by removing the reproducer from the phonograph and putting on the Victophone. Adjust the pole regulator until the tone and volume are correct. No batteries are required. The Victophone's usefulness in the home lies in its adaptability to varied requirements. It does not interfere with the home appointments, and is not in the way.

New Fada Vernier Rheostat

SIMPLICITY is the keynote of the new Fada vernier rheostat made by Frank A. D. Andrea. Ease of operation is brought about through single contact lever, strong solid parts, moulded insulation and a single knob control of resistance.



Vernier rheostat

The rheostat knob turns easily and smoothly and is always effective, for steady electrical contact is assured through careful construction and selection of contact materials. The Fada vernier rheostats are adaptable to any style of mounting. Vernier attachment can be purchased separately for converting ordinary rheostats to the vernier

A New Burgess "B" Battery

THE Burgess Battery Company announces a new and more convenient type of large size "B" battery, designated as No. 2158. The new "B" battery may be called a "vertical battery" as it stands on end and has its terminals on the top similar to the dry battery. It is four inches by three inches cross section and six and three-fourths inches high and occupies less than one-half the space taken by the usual "B" battery of equal capacity. Its voltage is 22.5 and the terminals are two binding posts with knurled nuts.

Incorporated in this battery are the well-known Burgess features of seamless drawn zinc cans, individual cell insulation, thorough moisture-proofing and improved series connections.

The advantage of this battery is that it can be conveniently connected in sets which have small vertical spaces in the back of the

New type B battery

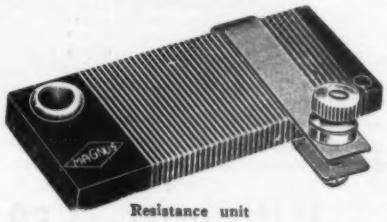
cabinet. A number can be bound together in compact units with dry "A" batteries and used with portable sets. The battery is especially useful for loud speakers where four or more are used together to produce a high potential, as they can be easily tied or wired together into a solid package.

New Brandes Headband

C. BRANDES, INC., has recently been granted a patent on an improved headband for telephones. One of the principal features of the invention is a device for adjusting the receivers to the ears of the user. This is in the form of a collet chuck having a concentric aperture in which a rod forming a part of a receiver supporting member is slidably and rotatably mounted. By means of an adjusting nut having a tapered thread engaging the collet, the latter may be contracted to securely grip the rod, and thus when the receivers are adjusted to the satisfaction of the user he may, by simply turning the adjusting nut, fasten them in that position. This device, as will be seen, engages the rod on practically its complete circumference, and its design is such that a powerful gripping action is obtained even with a relatively slight turn of the nut. Another feature consists in the use of a pair of washers having grooved adjacent faces between which the ends of the wires forming the frame of the headband are rigidly secured.

Magnus Resistance Unit

THE Magnus Electric Co. has put on the market a new type of fixed resistance known as type No. 831. The maximum re-



Resistance unit

sistance of the new unit is 30 ohms. It was designed expressly to supply the need of a rheostat of a larger resistance for 1½-volt tubes when used on 6-volt sets. These resistance units are used with all standard rheostats. It is not necessary to remove the rheostats in the set, the only operation necessary is to unscrew the binding post from one terminal of the rheostat and place the resistance unit over the opposite binding post.

The "Amrad Portable"

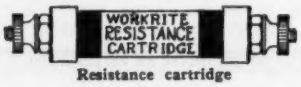
THE American Radio & Research Corporation has put on the market the "Amrad Portable," a small, self-contained single-tube outfit. The set is enclosed in a

Portable receiving set

convenient carrying case and its compactness and light weight make it easily portable. A dry battery tube is used.

WorkRite Devices

THE WorkRite Resistance Cartridge is a device made for use with regular 4 to 6-ohm resistance rheostats and the new high resistance detector tubes. A 25-ohm



Resistance cartridge

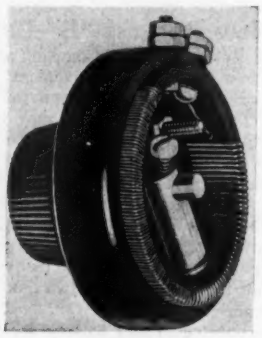
resistance cartridge is made for use with the UV199 tube and 15-ohm cartridge for use with the 201A and 301A tubes. The WorkRite Resistance Cartridge connects into the circuit with the regular rheostat and raises the resistance to the 15 or 30 ohms required.

Non-microphonic tube socket

The WorkRite non-microphonic socket has been developed for use with the new UV199 tubes. These tubes require a base of soft rubber on which the socket rests, and the WorkRite socket is moulded with a base of sponge rubber in one piece.

Crosley Multistat

THE Crosley Multistat is a universal rheostat designed for use with all known makes of vacuum tubes. It will be observed from the illustration that a certain carefully graded part of this rheostat is wound with comparatively low resistance wire. It is on this portion of the rheostat that perfect control of the 200, 300, 201, 301, WD11 and WD12 tubes is found. The balance of the rheostat is carefully wound with higher resistance wire for the control of the 201-A, 301-A, De Forest DV-6, UV-199 and C-199 tubes. The total resistance of this rheostat exceeds 20 ohms, and is the solution of the rheostat problem in connection with all makes of tubes.



Crosley Multistat

Gould Unipower Battery

THE Gould Storage Battery Company has developed and put on the market a new battery and charging device called the Unipower, by means of which batteries of receiving sets can be simultaneously charged.

The Unipower battery will supply filament voltages of 2, 4 and 6, and is provided with graduated resistances so that any fraction between the primary voltages may be used if desired. Plate potentials can be obtained from the device in two-volt steps, from 2 to 120 volts.

A new type of electrolytic rectifier is used as the charging element of the new battery and this unit can be direct connected to any lighting or power system of 110 volts, A. C., 25 or 60 cycles, and also 110 volts D. C.

Radio battery and charging device

The Gould Storage Battery Company has prepared a booklet on this new unit, "Gould Unipower Battery," and copies are now available to those desiring them.

Efficient Transmission Without an Antenna

THERE was a little discussion on some technical point between Bob Morton and Henry Poole at the Club the other night. I don't know just what it was about, but Bob, who is chief operator on one of the biggest liners crossing the Atlantic and happens to be home on leave at present, must have been warning Henry not to place too much reliance in rules, for I heard him say "There are exceptions to every rule, in radio as in everything else."

Henry is the latest one to be bitten by the radio bug in Hillyard and he totes two or three textbooks around in his pockets nowadays. He started to turn over the leaves of one of them and with an air of profound irony quite well done for his fifteen years remarked, "I suppose, now, there's an exception to this: 'A properly constructed aerial is essential to the efficient operation of a transmitting set.'"

Eight or nine members of the Club were sitting around and all snickered at the poser.

"Well, I've seen a transmitter that delivered the goods efficiently enough without having an aerial of any kind," Bob retorted dryly.

"It had some special ground attachment that served the same purpose." This from Henry in an excited voice. He was obviously uncomfortable now that there was an audience listening in.

Bob smiled pleasantly at the bright eyed boy. "In the case I am referring to there was no earth connection," he said. "Of course, no one would dispute the accuracy of the rule you quoted so far as everyday radio is concerned. But suppose you were operator on a ship that struck a fatal leak during a stormy night. The engines stop, the boat is mercilessly battered by the sea, and the foremast is carried away taking the aerial with it before you have had a reply to your SOS. What do the rules say to do next?

"I'd fix up an emergency mast with lumber from the top deck or from—or from some other part of the boat, and rig another aerial to it," declared Henry.

"Very good indeed for a boy who has always lived inland. But I omitted to mention that the boat is of the one deck variety commonly described as a tramp, and that deck is awash with the waves rolling over it incessantly by the time the mast goes. Also the dynamo stops and everything is dark as ink. All the crew are clinging to the rigging or crowding on a bit of space atop the wheelhouse just outside the wireless cabin. There is no possibility of erecting an emergency mast nor of stringing out an aerial in any other way. Your power transmitter is of no use now that the dynamo has ceased to run, but you still have the ten-inch spark coil with a battery of wet cells. What's the next move, eh?"

"So far as I can see the equipment should be thrown overboard to lighten the ship, that is if there wasn't any chance of raising an aerial by means of a kite, or by casting out a lifebuoy with a wire running from it to the top of the mast that was standing."

"I'm sure you wouldn't give up trying to make the outfit work, and that's the spirit," Bob rejoined. "But I'll tell you how Jim Lanberry got around conditions which didn't permit of raising an aerial. I was assistant operator to Lanberry on the *Bella Fay* running between Cadiz and Cardiff several years ago, and one night in the Mediterranean she got worsted in a storm just as I have described. Shortly after the foremast went both the small boats were smashed and not a man on board expected to set foot on land again. Lanberry and I considered scores of plans for continuing our distress call but all were impractical, and then he hit on the idea of lengthening the leads to the spark coil and hoisting that instrument by the aerial halyard so that the SOS could be flashed out from the mainmast. This we did, fortunately having enough insulated wire for the long leads, and when Lanberry tapped on the key the sparks looked as if they would be visible through the black night for fifty miles. A French steamer investigated the unusual signal and, to state it briefly, rescued us at dawn only a few minutes before the *Bella Fay* took the long dive.

"Thirty-one men were saved from becoming citizens of Davy Jones's country because Lanberry didn't admit that a wireless transmitter minus an aerial was useless," Bob added. "Of course, no one suggests that Lanberry's method has any value for ordinary purposes, but the incident goes to show that everything isn't stated in the textbooks."

Henry agreed. "But why didn't the French boat respond to the distress signals which you sent out in the usual way before the mast broke?" he wanted to know.

Bob laughed heartily. "It was lucky for us that the aerial did get carried away, or we might have been making ether waves until we were dipped into the wet ones. The rescue ship was not equipped with wireless."

INDUSTRIAL INKLINGS

Large Increase in Business

NOW that sultry weather is here and dealers are beginning to wonder how they can double their sales, a hint, and in fact several such, can be had from Trenton, N. J., where the Radio Chain Stores, Inc., is looking on the present and to the future with more satisfaction than it can derive from remembering the past. The enterprise was started in April, 1922, when a store at 230 East State Street was stocked "with about anything that could be bought that looked like radio merchandise." Leon Abrams, president of the company, had had a course in a radio school in code work and radio technique. Maurice Abrams, his brother, joined him as secretary and treasurer, and within a few months the business was incorporated.

The early days were rather hectic, being marked by the expenditure of considerable sums on the firm's part for advertising and demonstrations. Some $7,000 was thus spent, and none too wisely, the Abramses are now convinced. Also, the sale of unknown brands of merchandise resulted in dissatisfaction to many customers, and in heavy service expenses incurred in making poor receivers work and in keeping them working. That was the situation as late as last January—stuff looking like radio apparatus going out, and also a lot of time and money being spent to keep it out.

Then the Abrams brothers began to notice something. It was nothing new; plenty of dealers have gone through the same process. What had happened was this—some standard receivers had been secured and sold. Five RC sets and thirty-five Aeriola Seniors had been disposed of. And, say the Abrams brothers, the firm found itself possessed of the same number of satisfied customers. No kicks. No expensive service. Instead, satisfaction, pleasure, and compliments. Some of the buyers acted as if the store had done them a favor in selling them those receivers! This was new; something had to be done about it.

A corner of Radio Chain Store Co.'s store, Trenton, N. J.—The company reports a big increase in sales since complete sets have been handled instead of parts

This was done—by aggressive selling methods the orphan sets and parts were cleared out. Not exactly cast out, but cleared out. The firm by then was working from hand to mouth, not desiring to take in additional capital. Things had to be done economically, and done they were. By February, the RCA line, headed by the Senior and the Radiola V, came marching in on the tail of the fleeing would-be apparatus.

In four months the firm sold twenty V's, eighty-two Seniors, twenty-six Radiola Grands, and in the first three weeks that they were available, seven Radiola IV's. All this to a total of over $20,000, including extras such as loud speakers, tubes, batteries and phones.

Convinced that at last the correct principle was being observed, and that success could be had only with recognized apparatus of merit, the brothers began to look for further expansion. In establishing the company as Radio Chain Stores, Inc., they had had three ideas: a number of stores under central control; a field force of both salesmen and service experts, and advertising through all profitable media. Excellent fundamental ideas, but ideas that must be based on good merchandise.

Today the firm operates not only its own store, but also the radio departments in the

The Prize Winner in the RCA Window Display Contest

THE first prize of $250 in the dealers' window display contest of the Radio Corporation of America, held between April 8 and May 5, has been awarded to The Pfahl Electric Company, 3074 West 25th Street, Cleveland, O. A reproduction of the prize-winning display is shown in the accompanying illustration.

The rules of the contest required that the display must be made between April 8th and May 5th, and contain a feature Radiola RC or Radiola V or both. No other material either RCA or other make was to be in the window. The dealer was required to have in stock or on order four Radiolas RC or V or both at some time during the contest.

Altogether, over 100 dealers and jobbers took part in the contest bringing out much originality and decorative ability. The first prize was awarded to The Pfahl Electric Company because a live girl operated the set in a camp scene and the music was put on a loud speaker over the door.

The nine prizes awarded totalled $1,000. The contest was so successful that another has been planned for the Fall, which will follow an extensive advertising campaign in national magazines and newspapers.

Modern sales methods employed by live radio dealers include more than a mere display of apparatus

Put the kiddies to sleep with bedtime stories from your Radiola senior—the RCA nurse

Radio's greatest aid to mankind is its service to the ill and infirm

S. P. Dunham department store and in the Goldberg store. Each department is furnished with a salesman who is sufficiently skilled in radio to render service, but who is essentially a salesman. Customers of any establishment may avail themselves of the service department for installation and maintenance. Three Ford cars are kept in use by the sales and service staff, one of them being kept ready at all times for urgent calls, and there is also a Ford sedan for demonstration and special work. This transportation equipment enables the firm to cover not only Trenton but also the suburbs.

As the company says: "In order to get, one must give, give liberally in service before the sale by showing what radio will contribute to the family circle. Give them quality apparatus when they buy and quality service along with the purchase. They will give your enterprise enthusiastic co-operation, and every satisfied customer becomes a friend.

"We have all made more friends through radio sales than we ever thought was possible to make in any business. It is a reward worthy of anyone's best efforts—a profitable business and friends."

H. F. BOECKEL has left the Milnor Electric Company and is now with the Cleartone Radio Company.

ANOTHER manufacturer who has added a valuable contribution to the betterment of radio merchandising is the Colin B. Kennedy Corporation of St. Louis, Mo. The dealer who writes for a copy of their *Dealer Helps* will be well repaid in ideas for the cost of his request, whether or not he handles the Kennedy line.

THE Hartzell Sales Company announce the opening of a branch office at 1615 West Genesee Street, Syracuse, N. Y., to be in charge of Arthur C. Smith. The Syracuse, New York, branch office of the Hartzell Sales Company will cover all of New York State territory, with the exception of Greater New York and a radius of fifty miles therefrom.

THE Westinghouse Electric & Manufacturing Company announces a plan whereby all employees may participate in the purchase of a new issue of 20,000 shares of common stock to be paid for on the deferred plan at $53 a share (par value $50.) Each employee may subscribe for one to twenty shares of stock and pay for it in ten consecutive monthly instalments. Subscription rights are for the benefit of the individuals employed and are not transferable.

THE National Light & Electric Company has purchased the four-story brick building at 57 Lafayette Street, Newark, N. J., and also a four-story brick building just around the corner on Mulberry Street. The buildings join at the rear.

THE Reliable Parts Mfg. Co, Cleveland, O., has sent out a call for an expression of opinion from everybody interested, asking for ideas as to how to classify dealers, jobbers and consumers.

THE June issue of "Brandes Broadcast" contains an article by H. A. Abrahamson about "how a radio retailer makes real money by clean merchandising" that contains many valuable suggestions for radio merchants everywhere. Copies of the "Brandes Broadcast" will be supplied upon request by C. Brandes, 237 Lafayette St., New York.

F. CLIFFORD ESTEY, president of the New England Executive Radio Council, has severed his connection with the Clapp, Eastham Company to become president of a new company that will supply the trade with a complete assortment of molded parts and a full line of licensed regenerative receiving sets.

Mr. Estey is well known in the radio field, being one of the oldest amateurs in the country, having built and operated Station 1AFV at Salem, Mass., which was one of the first successful amateur stations in trans-Atlantic work. Mr. Estey is a member of the Radio Club of America, the Institute of Radio Enginers and a director of the Radio Trade Association.

AT a general meeting of the Electrical Supply Jobbers Association of Chicago, held at Hot Springs in May, the following recommendations were presented by the Radio Committee and unanimously adopted by the Association:

That manufacturers of radio materials supply their distributors with standard size 8½ by 10 inch price and data sheets.

That defective tubes and radio materials returned to manufacturers, where such returns are permitted, be credited rather than replaced in the interest of economy by the elimination of handling small shipments as in most cases the distributor has already made replacement or adjustment with the dealer.

That all portions of inside of instruments depending on the strength of panel for support be reinforced by extra individual support of such unit so mounted to prevent breakage by rough handling.

That manufacturers pack and ship receiving sets in individual cartons or crates of sufficient strength to permit reshipment in original package.

That all manufacturers of receiving sets of a value of $25 or over, supply these sets with a serial number to facilitate the tracing of lost or stolen sets, and that the serial number and catalog number appear on the outside of the container where it will appear to the best advantage in stocking on distributors' and dealers' shelves, and further recommends that manufacturer, distributor and dealers use serial numbers on their invoices.

That the present practice of alloting radio materials on which the demand exceeds the supply be changed to conform to the practice of manufacturers of other lines handled by distributors, thereby rewarding distributors who create business and placing supplies where the demand is most urgent.

"ACME APPARATUS" is the title of an instructive booklet recently issued by the Acme Apparatus Company. This booklet contains much information of interest and value to the broadcast listener and amateur, including fifteen circuit diagrams.

THE Electric Storage Battery Company, of Philadelphia, has made the common stock of the company available to its employees on the deferred payment plan. This company recently created a pension fund for employees and also recently made available to them a fully equipped club house, for recreation purposes.

MANY years ago, the Elizabeth, N. J., Board of Works passed an ordinance prohibiting peddlers and others from making noises on the streets. This ordinance was invoked recently to stop the use of loud speaker horns in front of stores of radio dealers. The Chief of Police of the city says the use of these horns violates the ordinance as a "nuisance." The dealers argue that the ordinance was passed before radio was thought of, but the Chief was obdurate and said the use of horns for broadcasting music and speech will have to end. The dealers indicated they would fight the police ruling.

THE Roller-Smith Company, 233 Broadway, New York, announces the appointment of H. D. Baker, 525 Woodward Ave., Detroit, Michigan, as its representative in the State of Michigan and Mr. Baker will handle the Roller-Smith Company's lines of instruments, circuit breakers and radio apparatus in that territory.

India Studies Radio Broadcasting

By S. B. BANERJEA

UNDER the presidency of Mr. H. A. Sams, Director General of Posts and Telegraphs, a Radio Broadcasting Conference was held at Delhi, India, recently. Some twenty representatives of the manufacturers and the press attended.

Mr. Sams opened the proceedings by referring to the advice of British manufacturers that only a single broadcasting company, a consolidation of manufacturers, should be permitted to transmit in India. The Director clearly pointed out that broadcasting would be permitted in India through a single licensed company, for the whole of India, under reasonable control. The company would consist of British and Indian firms only and American or any other non-British firm would not be allowed to have anything to do with it. A draft of the conditions of the license was placed before the conference and two sub-committees, one consisting of the press representatives and the other of the manufacturers, were then appointed to consider the proposals of the Government and suggest modifications.

A Hindu delegate questioned whether the term "manufacturers" would be limited to British manufacturers or not. He was told that imported sets from England only would be admitted, but permission would be granted to buy parts in the United States or foreign countries and assemble them in India.

Another delegate objected to a monopoly being granted to a single company; while another suggested that three companies, with headquarters at Calcutta, Madras, and Bombay, should be established, considering the great size of India.

Commander Nicholson, Director of Wireless, replied that the monopoly would be granted to a single company, which would have permission to allow smaller companies to broadcast in their respective areas. Newspapers and news agencies could become members of a broadcasting company. After some further discussion, the Government agreed to proceed on the lines indicated by the delegates. The terms of the license will now be discussed and a final decision made known at an early date.

In the meantime, it is interesting to note that radio enthusiasts are growing in number, and broadcasting demonstrations have been given.

Wireless music recently was heard at an open air concert. Mrs. Stapleton, wife of the Calcutta superintendent of the Marconi company, sang several songs at Temple Chambers, near Highcourt. The listeners, sitting on the exhibition grounds on Chowringhea, heard her from a distance of three miles, and came away highly delighted. Another wireless concert was held under the auspices of Lodge Temperance and Benevolence and was a decided success. More concerts have been arranged for. A wireless telephone demonstration has also been given before the chairman and members of the Calcutta Corporation and proved a success —so much so in fact that arrangements are being made to establish wireless communication between the city and the municipal water works at Pulta, 15 miles away. The idea is to link-up the water works system with a speedy and reliable means of communication. Telephones are apt to break down. The wireless system is sure to overcome all disabilities and will, therefore, be resorted to. I should state here that all these demonstrations are being conducted by the Indian States and Eastern Agency, who are the sole agents for the Marconi Wireless Telegraph Company.

An enterprising Calcutta newspaper recently held the first wireless telephone talk with a Marconi official sitting on the golf links at Khargpur, operating a motor-car wireless set. The distance between the two points is 72 miles by rail. The test was entirely successful.

It is understood that an oil company in the Punjale has adapted wireless telephony for cummunicating with its oil fields, which are forty miles away from the headquarters. The roads are bad and floods make communications uncertain. Besides, a wireless set costs less to erect and work than a telephone line and so the cheaper and more reliable method of communication has been resorted to.

Now, there are 29 radio stations in India; but some of these are not designed for commercial purposes. There are eight coastal stations, of which those at Bombay, Karachi, Madras, Rangoon and Calcutta are essential, "if telegraph facilities are to be provided between ships in the vicinity of India and Burma and with other parts of the world." Of the three other stations, viz., those at Victoria Point, Port Blair, and Diamond Harbour, the last one is of no value and its abolition has been recommended. Of the other stations, which will be "scrapped," wholly or partly, those at Patna, Paona and Ishakur will go immediately; the Maymyo Burma station will be partly dismantled; and those at Pashwar, Lahone, Quetta, Delhi, Jutoqh, Allakabad, Nagpur, Mhow and Secunderabad will be placed "in care of maintenance parties which will keep the stations in running order and ready for service on six hours notice."

New stations are being opened at Mingaladon and Madras for commercial service in 1923-4. These economies are expected to save 453,000 rupees in 1923-4. The Committee add:

"We are of the opinion, however, that the question of completely dismantling more of the stations should be considered. Many of the existing stations are quite incapable of carrying out commercial traffic and their use would be prohibited by the International convention within the next three years. We suggest, therefore, that it would be more economical to scrap some of the existing stations and, if necessary, apply any additional savings for the purpose of bringing existing essential stations up-to-date."

Radio Fog Signals

THE following radio fog signals are now being operated by the United States Lighthouse Service:

Fire Island Light Vessel, N. Y.—Groups of two dashes for 25 seconds; silent, 25 seconds.

Ambrose Channel Light Vessel, N. J.—Single dashes for 20 seconds; silent, 20 seconds.

Sea Girt Light Station, N. J.—Groups of three dashes for 60 seconds; silent, 6 minutes.

Cape Henry Light Station, Va.—Groups of two dots followed by one dash 20 seconds; silent, 15 seconds.

Diamond Shoal Light Vessel, N. C.—Groups of two dashes for 30 seconds; silent, 30 seconds.

San Francisco Light Vessel.—Groups of two dashes for 30 seconds; silent, 30 seconds.

Blunts Reef Light Vessel.—Single dashes for 30 seconds; silent, 35 seconds.

These signals are operated continuously during thick or foggy weather, and in clear weather daily from 9 to 9:30 a. m. and from 3 to 3:30 p. m.

The signals are sent on 1,000 meter wave.

A vessel equipped with a radio compass may determine its bearing from these stations, although they may not be visible, and may also obtain the bearing of another ship equipped with radio.

In plotting radio bearings taken at a considerable distance on a chart of the Mercator projection correction must be made, as the line of bearing is not a straight line excepting in the meridian. This system is the reverse of that used by the United States Navy.

International Notes

By CHARLES BAILLY, Paris

THE laboratory for the study of military radio telegraphy has started its researches on the subject of the propagation of very short waves.

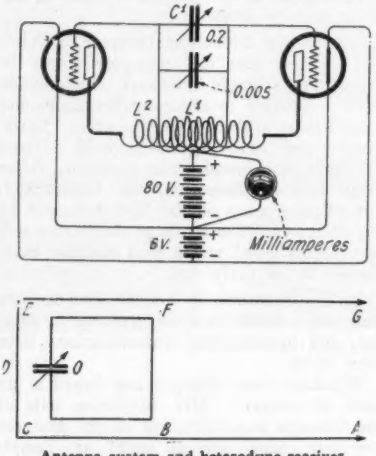
These transmissions, the first of which have taken place, will be continued during several months, on Tuesday, Wednesday and Thursday of each week on a wave length of 45 meters.

The antenna consists of a single wire of a length equal to one and one-half times the length of the wave, or 67.5 meters (229 feet), for the wave length of 45 meters. Of course one could make the antenna of a different proportional size with relation to the wave, but it seems that the length indicated gives results that are markedly more favorable than any other. The wire is insulated from the ground over its entire length, and coupled as closely as possible with the receiving apparatus, as indicated in the drawing. For instance one end of the antenna could be wound directly upon the primary tuning coil. The scheme is shown in the drawing in which the point D, the middle point of the antenna wire, coupled with the loop, is at a distance of one-quarter of the wave length from the inner extremity "A" of the antenna. It probably would be advantageous to orient the antenna in such a manner that the extremity G would be opposed to the direction of the transmitter, the latter in other words being located in the direction GFE. Nevertheless it would be interesting to study this matter of orientation of the antenna. One could also study the effect of changing the angle of the antenna EFG with the ground, trying it first parallel with the soil and then at a more or less high angle, and even testing the effect of verticality, if one happens to be able to find a sufficiently high support. Finally one might try replacing the portion "DCB" of the antenna by a good ground.

The receiving loop consists of a single turn on a square frame about 1.2 meters (about 4 feet) tuned by a variable condenser O with a maximum capacity of .0002 mfd. The two terminals of this condenser are connected to a detector and amplifier circuit, the detector being either galena or a tube. The receiving apparatus is completed by a heterodyne especially adapted to the scale of wave lengths on which the test is being made. The heterodyne may be especially made according to the following design.

The complete coil L2 consists of nine turns closely wound on an ebonite cylinder .08 meter in diameter. The grid coil L1 consists of seven turns closely wound directly over the turns of L2, but of course insulated from them. The middle points of the coils L1 and L2 are connected with the positive pole of the filament battery, the connection with the plate coil being made through a high tension battery of 80 volts or not less than 40 volts. The heterodyne thus constructed will oscillate upon wave lengths of from 35 to 70 meters. The condenser C1 should be variable with a maximum capacity of about .0002 mfd. It should be constructed with the greatest care in order to provide a very gradual change of capacity. In this connection a vernier would be valuable.

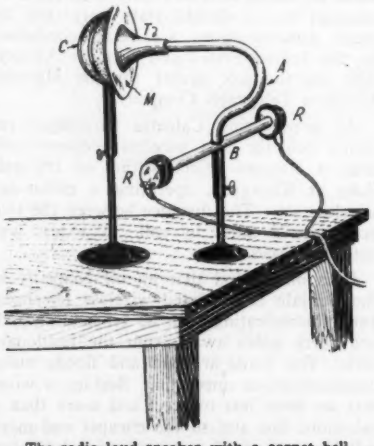
Reception is possible when the capacity of the condenser O of the receiving loop is different from the maximum value corresponding to resonance. Tuning is a matter which concerns the oscillating circuit of the heterodyne, which is extremely precise and constitutes the only delicate point in the operation of this receiver. Reception is accomplished through the use of values of capacity in the heterodyne condenser that are exceedingly close.



Antenna system and heterodyne receiver for short waves

The D.C. milliammeter reading from 05 milliamperes which is shown in the diagram, is not indispensable, but is very convenient in order to be certain of the operation of the oscillator. It is of course necessary to make sure that the heterodyne coil is placed in such a position that it has an inductive effect on the receiving apparatus.

MR. BOUDIN, director of the native school at Reibell-Chellala, in Southern Algeria, has succeeded in receiving broadcasting from the Parisian district on a loud-speaker that he constructed himself with parts that happened to be on hand. His apparatus is particularly original. This loud-speaker consists simply of a poilu's helmet, the horn from a bugle, the neck of a sprinkler, a metal tube borrowed from a camera tripod, and two bases for portable electric lamps. The assembly is shown in the drawing, in which the tube B is the one borrowed from the camera tripod, and bears at each end two small holders which retain the headphone R. This tube is supported by one of the portable electric lamp bases. At its middle point the curved neck of the sprinkler is soldered, while at the top of the latter, is fixed the horn from the trumpet. The bell of this horn barely touches a parchment membrane M stretched over the helmet C which latter is supported by the second of the two electric lamp bases.



The radio loud speaker with a cornet bell and French Army helmet

A RADIO club has been founded in Berlin by a number of experts and amateurs for the purpose of furthering the interests of amateur radio operators and of bringing general radio matters to the attention of the authorities. The offices of the Radio Club are at Stechbahn 1, Berlin C. 2.

In other countries the general and technical radio development has lately progressed far more than in Germany where today only a single private radio company exists. This, as noted in a report from Berlin has acquired broadcasting rights from the postal administration and enjoys the advantages of the wireless station at Koenigswusterhausen which it has leased from the government.

SEVERAL amateurs of the Radio Club Dauphinois, annoyed by interference from the electrical generating plant of the City of Grenoble, which prevented them from hearing the American broadcasting stations, have made test of receiving sets in the Dauphinois, above the snow line on a plateau dominating all the neighboring summits at 900 meters (6,270 feet) altitude. They installed an antenna consisting of a single wire 40 meters (125 feet) long. The receiver consists of an antenna tuning variometer, with one stage of radio frequency and two stages of audio frequency amplification. The radio frequency stage uses a tuned transformer and also regeneration between the variometer and the plate circuit of the detector lamp. In the first test the operators heard the Eiffel tower, FL, very loudly, the words and music being comprehensible nearly two feet from the headphones. Toward four o'clock in the morning, having perfected their apparatus, they were able to hear quite clearly three American stations, one of which was WOR. One of these was sufficiently powerful to enable the amateurs to add two stages of audio frequency and listen to a concert for a half hour. About five o'clock a storm came up and terminated the reception.

WHILE exploring in the African desert, 500 miles from the nearest settlement, Angus Buchanan, of the British Museum staff, was badly injured and but for timely medical advice obtained from Algiers by radio, would probably have succumbed to his injuries.

While climbing among the hills he slipped for nearly 100 feet and was badly bruised and slightly injured internally. Natives carried him fifty miles to the nearest wireless post occupied by an isolated squadron of French soldiers. Instructions from doctors at Algiers on how to treat the injuries were obtained by radio.

Within three days Buchanan had sufficiently recovered to allow a resumption of operations by his party.

The Monthly Service Bulletin of the

NATIONAL AMATEUR WIRELESS ASSOCIATION

Guglielmo Marconi, *President* | J. Andrew White, *Acting President* | H. L. Welker, *Secretary*

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Organization of Broadcast Listeners

By Kenneth M. Swezey

RADIO broadcasting has attracted tens and hundreds of thousands of people, from all walks of life, to a subject that was but a short time ago left principally to the professor and the engineer; being thought too profound and complex for the average intelligence. The rather abrupt change in affairs brought about a situation that was both good and bad. It was good in that it awakened in the public consciousness an interest in a most useful science; and further, an increased interest in literature, music, education, and the doings of its neighbors the country over When before did a New Yorker know or care what was going on in Davenport, Iowa? Why should he? Consider the distance and the many hours it would take to get there. But with transportation at the speed of light no one is debarred the journey.

The bad side of the situation is important, but need only be temporary. As might be expected, when something very new and attractive is offered to a gullible and uninitiated public, troubles will immediately rise. In this case, technical difficulties were foremost; enhanced, of course, by the enormous stock of inferior apparatus that was passed off by ignorant and unscrupulous manufacturers. Then came the question of the quality and scope of the broadcast program. Some stations insisted that the listeners wanted nothing but jazz, and others that they wanted nothing but educational talks and opera. Some took what talent they could get, and said nothing, disregarding entirely their duty in the way of service. The result of this indifference was a waning interest on the part of the listener.

Today, things are brighter. The beginner of a year ago has mastered many of the difficulties of his apparatus; and most of the broadcasting programs deserve nothing but commendation. The inferior apparatus is gradually making room for that of a better grade. But there is still one thing that the radio audience lacks, and that is unity; it consists of a million or so unconnected parts. The transmitting amateur radio enthusiasts have been organized in local and national groups for years, and have developed a remarkable strength and fraternal spirit. Why cannot the broadcast listeners do the same?

A club for the new fans would have to differ considerably from the clubs of the old time amateur, for an almost entirely different condition has to be dealt with. The amateurs are in the game for the sake of radio itself; they are willing to give up money, sleep, time, and energy to their hobby. But the fans are just everyday human beings, having the likes and dislikes that are common to most of us. A club for them would have to be more of a social affair, aiming principally at good fellowship, hovering around the subjects that are included in the broadcast programs, and adding an occasional technical discussion. There is such latitude in the matter that a church, school, society, or community center could adjust such an organization to suit their particular need.

For an example let us organize a club in the local Y. M. C. A. Here we have our limitation of including only boys and men. Our purpose is to provide good fellowship, an interest in broadcasting in general, a place where the members can talk over their troubles and discoveries, and a place where they can receive at least elementary instruction in the technical side of the art.

In the meetings, every effort should be made to afford variety and so keep up the interest; otherwise the membership will soon melt away. Outside speakers generally have considerable pulling power. Persons who have spoken or performed at one of the broadcasting stations are especially attractive. In addition to this the services of a technical man, should be secured who will always be on hand, ready to give aid and advice to those who need it. If it is thought desirable, an elementary course in radio principles can be given. A few members may even want some code instruction.

Now, just what are the advantages of having the broadcast listeners organized? In answer to this we can fall back on the old maxim that in union there is strength, and another that two minds are better than one. The members could discuss problems that would be mutually beneficial; what one don't know the other can make up for; and circuits could be compared and theories thrashed out. The broadcast fan could get the systematic instruction that he now gets in disjointed lumps. Apparatus could be purchased and workshop facilities could be provided that would be beyond the means of the individual. Those who could not afford to have sets of their own could come and listen-in at the club room, thereby enjoying privileges not otherwise possible.

A radio audience having complete knowledge of the apparatus with which it works, would solve the junk problem entirely. A person who is able to tell the good from the bad will take only the best, and the rest must necessarily be relegated to the discard. A manufacturer could not dispose of an instrument that did not pass the approval of the club's test committees or some other responsible group. Arrangements might be made whereby club members could buy apparatus at a discount. The knowledge of proper operation would also reduce the amount of interference caused by the radiated oscillations from tube sets.

It is even feasible to bring about the organization of a national association of broadcast listeners, grouping together the local clubs under one common head. Here, indeed, would be a power. With such an organization, broadcasting would cease to be an experiment, and could be made to render a genuine and well-defined service. Votes could be taken, and there would be no uncertainty about what was wanted on the programs. Definite information could be secured regarding the range and quality of the various broadcasting stations; and the government could use some of the data in granting and revoking licenses. The transmitting amateurs of the United States have built up powerful organizations for protection and betterment of conditions and it seems entirely reasonable to believe that a national organization of broadcast listeners would be of great advantage to the government, the broadcasting stations and the listeners.

[We should like to have our readers' opinions of and suggestions for a national organization of broadcast listeners.—THE EDITOR.]

△ △

UNITED STATES Civil Service Examination for radio positions are listed below. Applications for these examinations may be had from the local secretary of the Civil Service Board at your Post Office, or, if not available there, may be secured from the U. S. Civil Service Commission, Washington, D. C. The examinations are held simultaneously on the dates given in several cities in each state, applicants presenting themselves for examination at the nearest examining office.

Junior Engineer, Junior Physicist. The examinations will be held throughout the country on September 5. They are to fill vacancies in the Bureau of Standards, Department of Commerce, at entrance salaries ranging from $1,200 to $1,500 a year, plus the increase of $20 a month, and vacancies in positions requiring similar qualifications.

Examinations will be given in the following optional subjects: For junior engineer, ceramic engineering, civil engineering, chemical engineering, electrical engineering, engineering of materials, mechanical engineering, and radio engineering; for junior physicist, electricity, heat, mechanics, optics, physical metallurgy, and radio.

△ △

THE Bureau of Foreign and Domestic Commerce, Department of Commerce, has received a request from a German radio club for a connection with American radio clubs. This request is made through the United States representative in Berlin and the interest of the German club is confined, apparently, to those owning receiving sets and listening in regularly on the radio telephone broadcasts. The address of the German Radio Club (Deutscher Radio Club) is Berlin, Belle-Alliancestrasse No. 30. The members wish to exchange publications, reports, information, etc., with American amateur organizations.

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MUCH interest in the Zenith receptor has been aroused among members of the Milwaukee Radio Amateurs' Club, Inc.; several have built models according to specifications recently given before a club meeting by R. H. G. Mathews, 9ZN, engineer of the Chicago Radio Laboratory, and have reported favorably on the receiver's merits. Among these were E. T. Howell, Sc. M., vice president, and the club's recently appointed assistant treasurer, F. W. Catel, 9DTK, sometime an operator for the defunct United Wireless Telegraph Company.

A good share of one of the season's last meetings was taken up with a discussion of the super-heterodyne receptor, with E. T. Howell, 9CVI, and H. F. Wareing, pre-war 9AEX and president, leading. At the concluding meeting of the season of 1922-23 Business Manager L. S. Hillegas-Baird read Dr. D. B. MacMillan's parting message. This last statement was prepared by Dr. MacMillan shortly before he left for the Arctic regions.

Regular weekly metings on Thursday evenings in the Public Museum Trustees' Room will be resumed by the society about the middle of September. The club's directors and officers will hold several mid-summer meetings at which plans will be formed for the Fall membership campaign. The club's address is 601 Enterprise Bldg., Milwaukee, Wis.

△ △

THE first successful spanning of the Pacific Ocean on schedule has been demonstrated, according to reports from H. K. Love of the Wireless Institute of Australia.

Reception of amateur signals has been reported from time to time by operators on ships off the coast of Australia and China, one of these vessels having been at anchor in a Chinese port.

The recent tests were made at the suggestion of Australian amateurs, who, hearing of American DX records, desired to demonstrate that they were able to receive signals from western amateurs.

Although no long-distance records were broken, it is significant that American signals were heard clearly and consistently, and complete information from the receiving end may show that some amateurs east of the Rockies may have got their signals over.

The arrangements for transmission by American amateurs were in charge of a special committee headed by R. J. Portis of the Long Beach Radio Club, and it was largely through his efforts that Australia has now entered the "amateur radio league of nations."

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THE Chester County Radio Association, at a recent meeting at Parkesburg, Pa., has elected officers and completed plans for the compiling of the association's "year book."

Horace A. Beale, Jr., operator of station WQAA and experimental stations 3ZO and 3XY, also president of the Parkesburg Iron Works, was elected president; Thomas Appleby, Philadelphia, vice-president; David Logan, Philadelphia, secretary, and Charles K. Hallowell, Parkesburg, treasurer.

This association, one of the largest in the East, meets once a week at Parkesburg, special lectures on radio and scientific subjects featuring the sessions. The association also operates a portable station, 3OI, which is housed in a one-room cabin mounted on a truck. The station is fitted with receiving as well as transmitting apparatus.

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NATIONAL officers of the Radio Listeners' Protective Association, Inc., met in the Press Club room, Baltimore, Md., recently, and successfully launched Baltimore Chapter No. 1, with the following officers: F. W. Youse, chairman; T. Schloss, vice-chairman; Prof. W. C. Katencamp, secretary; E. W. Grill, treasurer, and Prof. James Longen, financial secretary.

A comprehensive program was outlined for the betterment of radio conditions in Baltimore and the United States.

L. W. Winterling was elected a member of the national executive committee from Baltimore. This committee is made up of the heads of the various broadcasting stations throughout the country.

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THE Essex County Radio Club, Newark, N. J., with a membership of twenty-five, plans to hold open meetings on the second and fourth Tuesdays of each month at 48 William Street, that city.

According to Max Schmit, Jr., president of the club, the charter will be held open to give those interested an opportunity to join as charter members.

At the meeting on Tuesday, members will debate on the subject, "Resolved, that the dry cell tube is more efficient as a detector than the six-volt tube."

Field work, code classes and theory discussion are on the club's program.

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DURING his seclusion in a little Indian village in Northern Alaska, Rev. John W. Chapman, missionary of the Protestant Episcopal Church, will communicate with other Alaskan towns and whenever possible send a message clear through to the States by means of amateur radio. This is one of the first instances in which radio telegraphy is to be used in mission work in far-away places where there is no outside contact except through native messengers.

For a number of years army radio stations have been used in Alaskan towns, one of these being forty-five miles south of Anvik on the Yukon River. A native messenger requires about two days to cover this distance. Occasionally a steamer stops at the mission village, but there is no way of knowing, except through radio, when this boat will arrive.

The Rev. Mr. Chapman will return in July. He is a man of many accomplishments, having a good knowledge of surgery, photography and some branches of electricity. He has supervised the installation of a lighting plant and a saw mill in his mission village and now plans to learn the international Morse code and operate the amateur radio station himself.

△ △

THERE is practically no end to the possibilities of radio for military use, an officer of the Signal Corps stated recently, adding that young men who wish to serve their country can do so in no better way than to become qualified in radio and to join the National Guard or Signal Reserve Corps of the Army.

There is no more interesting study for young Americans, he points out, than radio. It need not be taken up as profession, but merely as a part of one's general education.

Although little was known of the work of the radio intelligence section of the army during or since the war, it was one of the most spectacular. Radio direction finders were placed all along the lines, at a distance of about five miles from the actual front, and spaced about twelve miles apart. These receiving sets located the enemy stations in operation, recorded their bearings by means of directional coils, not unlike modern radio compasses, and forwarded the bearings to headquarters, where they were plotted on maps. The reports from many American radio observers enabled the staff to keep an accurate check on practically all the German stations all the time.

On one occasion, when the Germans were planning a big offensive, the code all along the line was suddenly changed. The old code, known by the Americans for some time, became valueless. But one German officer could not decipher a long message sent him in the new code and asked his commander to repeat in the old one. This was done and as the American intercepting stations copied both messages, the staff of experts at headquarters soon had a fair solution of the new code, which they eventually worked out in its entirety. The repetition of the message in both codes was more than they hoped for, and when the new code was transmitted to the French and British Headquarters, the American Radio Intelligence Service was credited with a big "scoop."

As an instance of the work of former amateurs, who served in the Signal Corps during the war, it is said that 73 per cent. of the 400 radio men engaged in intelligence work were ex-amateurs. Not a single "leak" occurred in the service, which intercepted 73,000 enemy messages and recorded 175,000 bearings on enemy radio stations. The country and the Signal Corps is greatly indebted to these amateurs for their war work.

THE Department of Commerce has authorized a broader band of wave-lengths for general and restricted amateur radio stations, and created a new class of amateur operator's license to be known as Amateur Extra First Class.

The new regulations sent to all District Supervisors of Radio under date of June 28 provide that licenses will be issued permitting the use of any type of transmitter by amateurs, with the restriction that only stations using pure continuous wave transmitters are authorized to work on wave lengths between 150 and 200 meters, and that stations using spark, AC-CW, ICW, unfiltered CW and phone are limited to wave lengths between 176 and 200 meters. The types of transmitters must be specified in the license application and shown on the license itself.

Special Amateur Radio Station Licenses will be issued permitting the use of pure continuous wave transmitters only, authorizing the use of wave lengths from 150 to 220 meters.

For the purpose of application to amateur stations, pure CW is defined as follows: A system of telegraphing by continuous oscillations in which the power supply is substantially direct current as obtained from (1) a generator, (2) a battery, or (3) a rectifier with an adequate filter. (A filter is not deemed adequate if the supply modulation exceeds five per cent.).

General, Restricted and Special Amateur Stations are not permitted to use a transformer input exceeding one kilowatt, or equivalent of this power based upon watts input to plates if tubes are used. (Where input rating of tube is not specified by manufacturer this rating will be considered as double the manufacturer's output rating.)

On licenses issued for amateur stations will be included the following; "This station is not licensed to transmit between the hours of 8:00 and 10:30 p. m., local standard time, nor Sunday mornings during local church services."

Special amateur stations must be operated by persons holding an extra first grade amateur operator's license, or a commercial first class operator's license, or a commercial extra first class operator's license. Applicants must also meet the requirements of Regulations 63.

A new class of amateur operator's license is established to be known as "Amateur Extra First Grade." Licenses of this grade will be issued to persons passing the required special examination with a percentage of at least 75 and code speed in sending and receiving at least 20 words a minute, five characters to the word; who have had at least two years' experience as a licensed radio operator, and who have not been penalized for violation of the radio laws subsequent to the date of these regulations.

Short Wave Directive Transmission

By MARK MEREDITH, Liverpool, England

IT often happens that after an invention has undergone many modifications and been improved until the original arrangement seems very crude, it is found necessary to adopt again a part of the earlier form which proves of unexpected value. This is notably the case with directive radio-transmission, for in the days when attempts were made to concentrate the radiated energy so that the greater distances could be reached in a given direction, and interference with other circuits prevented, the wave lengths employed were small, and reflecting devices could be used.

It was soon found that in order to improve the range of signaling with the insensitive detecting apparatus then being used, it was necessary to increase the wave length, and this tendency has increased until modern developments have brought into use waves as long as 30,000 meters. The invention and improvement of the thermionic valve has revolutionized reception, and interesting work is being done on the old lines with reflectors as a means of directing the energy for telegraphic or telephonic purposes.

It appears that excellent results have been obtained by using waves of 15 meters, generated by thermionic valves giving a power of 200 watts and an aerial current of 1 amp. After a successful attempt over land a test was recently made from Carnarvon, Wales, to a receiving apparatus on a boat running to Kingstown, and speech was received into the harbor, 70 nautical miles from Carnarvon. It has previously been found that the diminution in strength of the received energy was greater at low levels than at high and it was expected that greater distances than 70 miles could be covered under suitable conditions on land.

The result of a test between Hendon and Birmingham were very satisfactory and it was proved that the effect of the use of a reflector at each end was to increase the received energy 200 times. Experiments have also been made with a view to adapting the device to marine work. A revolving reflector was set on Inchkeith Island and a 4-meter wave from a spark transmitter used. The reflector revolved at a slow speed—one was sent at every half point. With a single valve receiver on a lighthouse tender a working range of several nautical miles was obtained.

It is obvious that by a suitable code of signals it will be possible to use revolving reflectors as a means of giving warning signals during fog, and as it was found during the experiments that a bearing could be determined accurately within 3 deg., the position of a danger point can be easily obtained. The work with experimental stations is to be continued, but the results have so far been such as to make it clear that this new method of direction-finding will certainly be developed further. The use of small wave lengths precludes the likelihood of interference from disturbance, but it introduces some difficulties in the tuning of the receiving circuit. There is, however, no doubt that these can be surmounted and if distortion and local shading can be reduced sufficiently, new fields of use will soon be found for signaling with reflectors.

Correspondence

TO THE EDITOR:

This is a reply to Mr. F. C. Miller's letter appearing on page 69 of the June issue of THE WIRELESS AGE.

I wish to assure Mr. Miller, that his letter which appeared in the June issue of this magazine was taken by me in the right spirit. In behalf of those who read my original article it is necessary that I elucidate thus:

He is correct in the strict sense of the word—the antenna I constructed and described in the May, 1923 issue of this magazine was not composed of Litzendraht cable. This cable was really "termed" Litzendraht, due to its construction being nearly that of Litzendraht, and in order to distinguish it from other wires employed for antenna construction. Again, because the wires were insulated from each other for their entire length.

Two drawings, were included with Mr. Miller's letter, showing cross sections of Litzendraht cable. From a purely technical standpoint I vow that wire No. 1 in drawing A is on the outside of the cable and at B on the inside, alternating throughout the length of the cable. That seems to be the trouble—Mr. Miller leans too much toward theory. I learned long ago that theory generally holds good on paper but in practice it is often a different story. What I desired to impart to the readers of this magazine was that the manufacturers of Litzendraht make every effort to arrange the wires in the positions shown with a view towards maximum effectiveness of the wire. . . .But—do they always accomplish that? And, can anyone vouch for the exact position of the wires at any given length of a Litzendraht cable?

If we take five wires and actually erect the cable it will be found that the outside surfaces of at least four, for any given length, are always effective. The explanation about a 48-wire Litzendraht cable bears no relation whatsoever to my cable.

Further on Mr. Miller shows great anxiety to dig into the highly theoretical factors responsible for the resistance of an antenna system. With all the text books at my command I could have reached the same conclusion arrived at—but that is another story.

Instead of referring to text books and the time-worn data I actually constructed and tested the antennas I wrote about and compared them against several other types of antennas using various kinds of material for the wires. My results pointed clearly in favor of the antenna employing a cable of five wires and I believe that is all that is necessary to prove the advantages of this type of antenna.—E. T. JONES.

Rules for Wartime Use of Radio

(*Continued from Page* 63)

Violation of this rule will justify the removal by the belligerent of the records of such intercepted messages.

Article 9.—Belligerents are under obligation to comply with the provisions of international conventions in regard to distress signals and distress messages so far as their military operations permit.

Nothing in these rules shall be understood to relieve a belligerent from such obligation or to prohibit the transmission of distress signals, distress messages and messages which are indispensable to the safety of navigation.

Article 10.—The perversion of radio distress signals and distress messages prescribed by international conventions to other than their normal and legitimate purposes constitutes a violation of the laws of war and renders the perpetrator personally responsible under international law.

Article 11.—Acts not otherwise constituting espionage are not espionage by reason of their involving violation of these rules.

Article 12.—Radio operators incur no personal responsibility from the mere fact of carrying out the orders which they received in performance of their duties as operators.

Queries Answered

Answers will be given in this department to questions of subscribers, covering the full range of wireless subjects, but only those which relate to the technical phases of the art and which are of general interest to readers will be published here. The subscriber's name and address must be given in all letters and only one side of the paper written on; where diagrams are necessary they must be on a separate sheet and drawn with India ink. Not more than five questions of one reader can be answered in the same issue. To receive attention these rules must be rigidly observed.

Positively no questions answered by mail.

Herbert L. Crawford, Terre Haute, Ind.

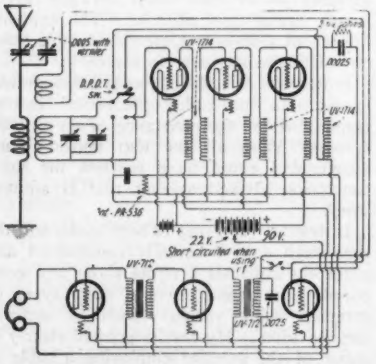
Q. Please publish the following information on the Wireless Specialty Co.'s set IP-501: How many turns of what size wire, how often tapped, and how wound on the primary and secondary bank wound coils? How many turns on the rotor and stator of the variometer? How many turns on the secondary coupling? What capacities are the condensers? Please publish hook-up.

A. We have no information relative to the windings on the Wireless Specialty IP-501 set. We suggest that you write to the Wireless Specialty Apparatus Co., Boston, Mass.

* * *

T. J. Conway, Bronx, N. Y.

Q. I would appreciate the publishing of a hook-up of three steps of radio-frequency, detector and three steps of audio-frequency amplification using honeycombs, with a throw-over switch when the audio would be used alone. I would like to have you state the transformers best suitable, but if you do not care to do this I would at least like to know the best ratio. Also what tubes would be most suitable. Should both variable condensers be of the vernier type and of what size? Does cambric tubing over the wires decrease the efficiency of a set? Some say it increases the capacity too much and that bus wire, bare, is best to use.



A. Here is hookup. We do not recommend using three stages of audio since you run into great difficulty due to howling and other noises. All the stages must be shielded from each other; placed in separate compartments, etc. Use UV-201-A tubes throughout. Cambric tubing does not decrease the efficiency of the set.

* * *

George F. Gottwald, Fall River, Mass.

Q. I have a copy of your publication dated December, 1922, last, and I am interested in a loud speaker subject therein which was won by C. P. Bernhardt. He gives quite a good deal of ideas or opinions on Baldwin type C phones for loud speakers, and towards the end of the subject you will note, that in the paragraph describing the diagram of the two-step transformer coupled amplifier, he states that a power tube is strongly recommended. Now, I have a detector and three-step amplifier and I was thinking that I would like to disconnect the third step from the detector and two-step, and use a Western Electric VT2 tube which is a power tube you well know, in the third step or fourth socket and run that from a separate storage battery, thereby having a one-step power amplifier. I have two Baldwin type C units connected in series and this is what I want to know. Will you kindly tell me just what is the maximum plate voltage, when using the power tube for loud speaker? I desire to give a public demonstration. I do not want to burn out the Baldwin phones. You may know that the Baldwin phones of the C type are wound for 1,000 ohms each, and I do not think it is safe to use any more than 100-110 volts, so will you kindly inform me the safe way and the correct voltage for the plate when using the two Baldwin units in series. Also tell me if any choke coil or resistance must be used, and what value, and where I can get them. When phones are in series they stand more voltage or current, and in regard to choke or resistance coils, no doubt you will suggest that they also be in series.

A. Baldwin type C units will not stand the power delivered by a power amplifier and will soon commence to rattle, if they do not burn out. We would advise obtaining a loud speaker which can stand the power. For detailed information on power amplifiers we refer you to articles in the December, 1922, issue of THE WIRELESS AGE.

* * *

John H. Meier, Oshkosh, Nebr.

Q. 1. I will be greatly obliged to you if you will furnish me with the following information. Who invented the first radiophone single regenerative circuit? When was this circuit patented? By whom?

A. 1. Edwin H. Armstrong invented the regenerative circuit in 1913. U. S. Patent No. 1,113,149. Single circuit and two circuit tuners had been used for about ten years prior to this time. Regeneration can be applied to either type of circuit.

Q. 2. How long has the radiophone been invented?

A. 2. The radiophone is not the invention of one man, nor was it a very sudden development. The radiophone of today represents the contributions of hundreds of scientists, experimenters and inventors during the past fifteen or twenty years, the most prominent of whom are Marconi, De Forest, Langmuir, Armstrong, Fleming, Heising, Colpitts, Round, La Tour. Each of these men has made some contribution to the art, without which radio broadcasting of today would be impossible. Experiments in radio voice transmission date back to the very earliest days of wireless telegraphy.

* * *

C. A. Nieto, Chihuahua, Mexico.

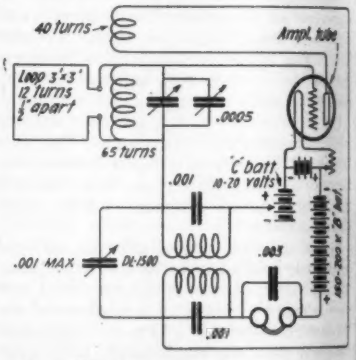
Q. The government of this state is now erecting a broadcasting station in this capital with a 2-kw. transmitter. The antenna has already been set up, and a room will be specially arranged for the transmitter. Would you kindly answer the following question in the Queries Answered department of your famous paper? In building a room for said transmitter so as to conform with the necessary acoustic rules, what instructions should be followed?

A. It is not necessary to place the transmitter itself in an acoustically treated room. A microphone and a speech amplifier are all that are necessary in the studio where the artists are assembled. The transmitter should preferably be located in another room. The walls and ceiling of the studio should be either lined with one inch thick (2.5 cms.) acoustical hair felt, such as is used in theatres, or concert halls, or else hung with draperies, such as heavy burlap. The floors must be covered with rugs. All these precautions must be made in order to avoid reflections of sound from the walls, floor and ceiling. These reflections would produce what is called standing waves, and tend to make voice or music unnatural, since sounds would not die away. For additional information we would refer you to The Johns-Manville Co. of New York City, and to several excellent texts on acoustics, such as W. C. Sabine's "Collected Papers in Acoustics" published by the Harvard University Press, D. C. Miller's "The Science of Musical Sounds," published by Macmillan Co., New York City.

* * *

Alfred H. Weber, Philadelphia, Pa.

Q. Kindly print a copy of Armstrong's super-regenerative single tube circuit with explanations or values of the various parts. Can a WD-11 dry cell tube be used to advantage in this circuit?



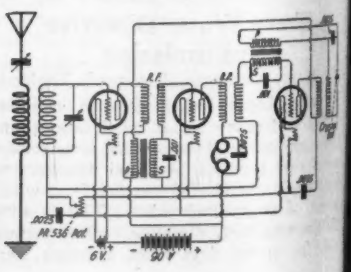
A. A WD-11 or other low power tube cannot be used advantageously. For best results a 5-watt power tube is required. See the February and March, 1923, issues of THE WIRELESS AGE for additional circuits.

* * *

Ralph T. Laffies, Newton, Mass.

Q. Could you tell me where I can get a blue print, or a drawing of the three-tube inverse duplex?

A. Below is wiring for 3-tube inverse duplex. THE WIRELESS AGE will shortly have blue prints of this and other modern circuits available.



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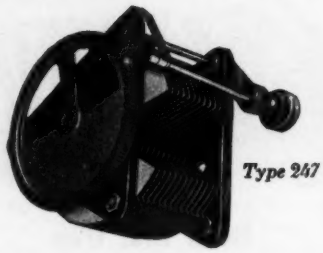

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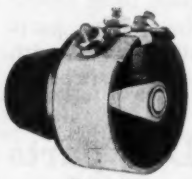

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4. And the well known General Radio Co. Amplifying Transformer giving maximum amplification without distortion.

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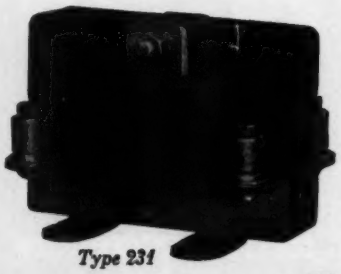

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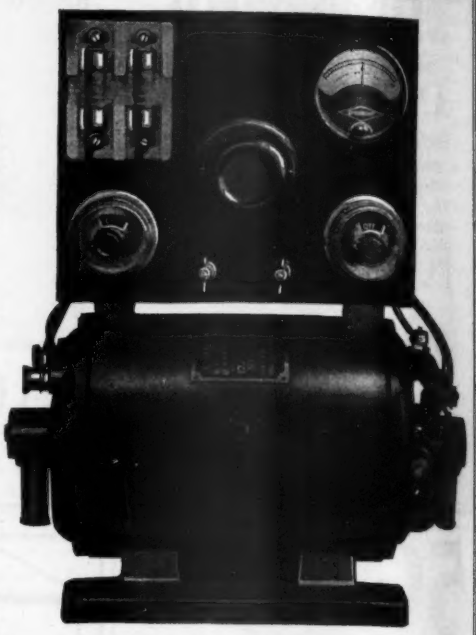

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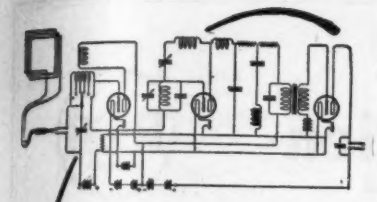

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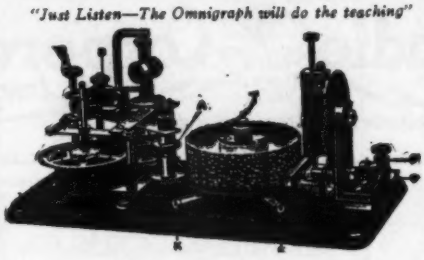

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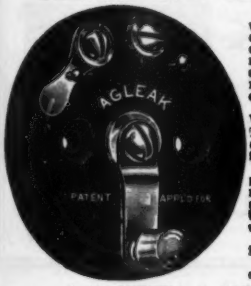

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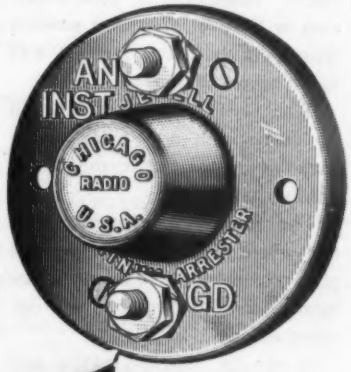

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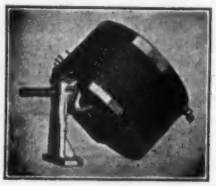

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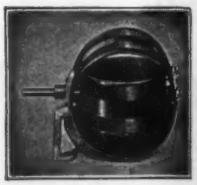

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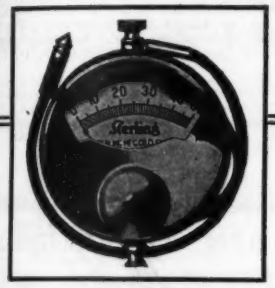

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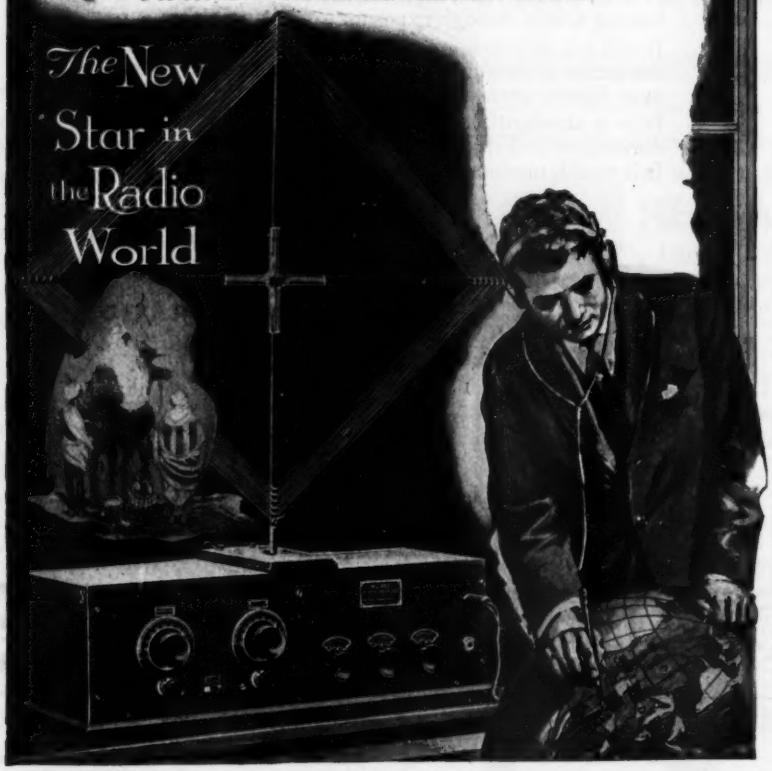

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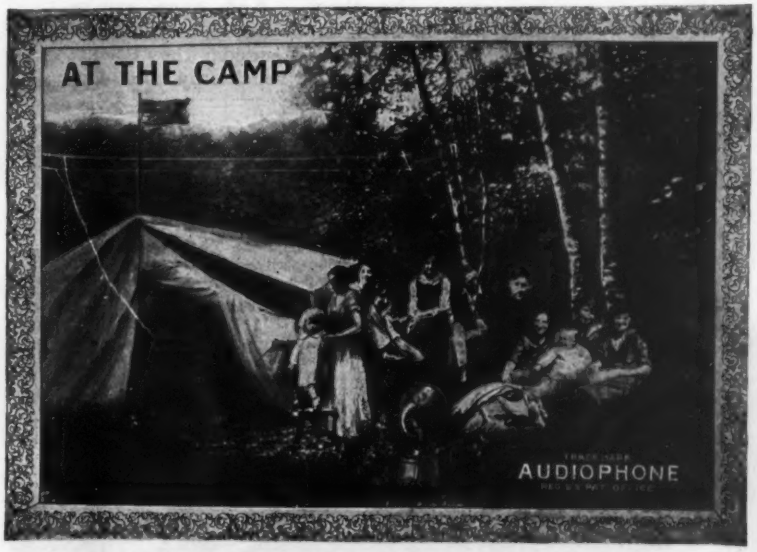

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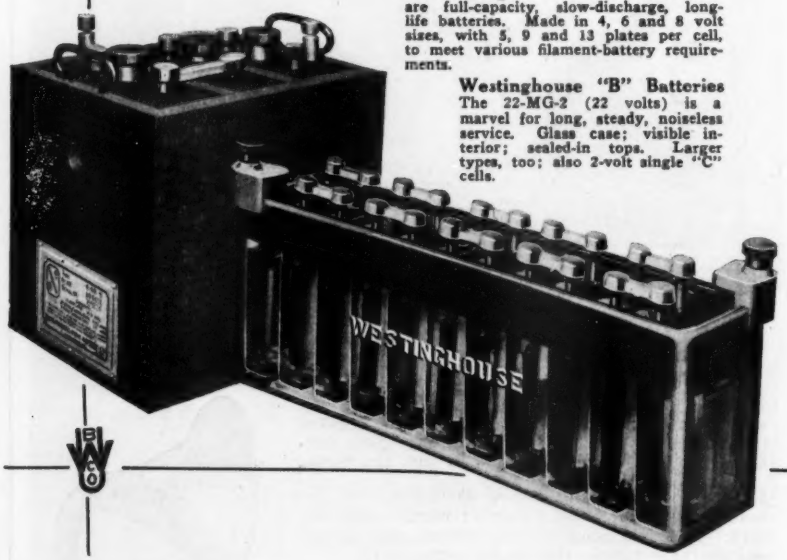

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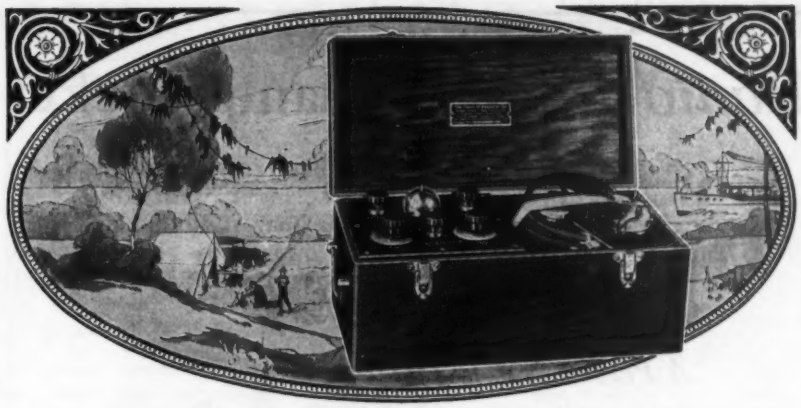

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5 ALW Bowder, Isaac A., 415 W. 13th St....Columbia, Tenn.
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7 OR David Ferguson, 3305 S. 8th St.....Tacoma, Wash.
7 OS W. A. Germain, 510 Girard St.....Bellingham, Wash.
7 OU D. S. Westmoreland.....Ilwaco, Wash.
7 OV F. J. Campbell, Route 1.....Hermiston, Ore.
7 OY R. J. Gleason, 1204 E. 62nd St.....Seattle, Wash.
7 OZ Garrett Lewis, 3235 33rd St.....Seattle, Wash.
7 PA M. B. Doughton, R. F. D. No. 1.....Albany, Ore.
7 PC R. C. Andersen, 3709 S. Alaska St....Tacoma, Wash.
7 PG Harry F. Genn, 542½ Washington St..Portland, Ore.
7 PK H. N. Bauer, R. F. D. No. 1.....Uniontown, Wash.
7 QD V. Jari, 641 Pine St.....Medford, Ore.

Eighth District

8 AM Elmer C. Immel, 1747 Forest Ave., W., Detroit, Mich.
8 AQ John P. Lippert, 1631 Elberon Ave., East Cleveland, Ohio
8 CF C. H. Katzenberger, 711 North University Ave., Ann Harbor, Mich.
8 CO Frank W. Haig, Kelly Island.....Cleveland, Ohio
8 CP Orie Palmer, 233 E. 11th St.....Holland, Mich.
8 LY Syracuse University (Elect. Engineering Dept.), Syracuse, N. Y.
8 VS W. S. Rumbough (Near Battle Creek), Camp Custer, Mich.
8 WU Penna. Wireless Mfg. Co., 507-511 Florence Ave., New Castle, Pa.
8 ZW J. C. Strobel & Earl Weimer.....Wheeling, W. Va.
8 AQI Arch W. Paull, Jr., Hamilton Ave..Wheeling, W. Va.
8 ASO E. H. Collias, 218 Connecticut.....Detroit, Mich.
8 AWN C. A. Petry, R. R. No. 1.....Dayton, Ohio
8 AAR Maurice Stebbens, R. F. D. No. 2, Saranac, Mich.
8 ACE Edward Van Peenon, 805 Miner Ave., Kalamazoo, Mich.
8 ACU Harold E. Schuls, 3536 St. Clair Ave., Detroit, Mich.
8 ADD Ray Schweinsberg, Erwin St.....Boonville, N. Y.
8 ADI Robert W. Galbreath, 202 East Main St., Endicott, N. Y.
8 ADO Howard C. Smith, 859 E. Delavan Ave., Buffale, N. Y.
8 ADQ H. Gilman & W. Roberts, 4150 2nd Blvd., (Portable), Detroit, Mich.
8 AEK Herbert G. Fullington, 435 Grace St., Pittsburgh, Pa.
8 AES Albert B. Fuller (Portable), 238 S. Goodman St., Rochester, N. Y.
8 AFS Bert E. Love, 118 Baker St.....Lansing, Mich.
8 AGJ Dean Carey, 363 Wyoming Ave.....Kingston, Pa.
8 AHH Charles E. Windecker, 447 Meister Ave., Painesville, Ohio
8 AIQ Lyle R. Palmer, Post St.....Boonville, N. Y.
8 AIZ W. Kennedy Foster, Jr., 36 Maplewood Ave., Crafton, Pittsburgh, Pa.
8 AND Frank D. Fallain, Police Bldg., Beach St., Flint, Mich.
8 APV Frank Dieringer, 3640 Mozart Ave., Cheviot, Ohio
8 ARA George L. MacCracken, 183 Dodge St. (Portable), Akron, Ohio
8 ARE Wade Carleton Durbin, 235 Southern Ave., Pittsburgh, Pa.
8 AWI John H. Culbertson, 901 Quincy St., Scranton, Pa.
8 AWN Clinton A. Petry, R. R. No. 1, Ft. McKinley, Dayton, Ohio
8 AYV Joseph Heferle, 2606 Consaul St.....Toledo, Ohio
8 BCA James C. Gill, 242 W. Main St.....Galion, Ohio
8 BCY F. V. Broady, 910 Prospect, S. E.Grand Rapids, Mich.
8 BCZ Anthony K. Wheeler, 67 Paige St....Owago, N. Y.
8 BDY Nelson R. Jewell, 351 High St., Benton Harbor, Mich.
8 BEE Glen H. Pickett & Howard Cochran, 207 Delaware Ave., Buffalo, N. Y.
8 BFP Walter A. Harrane, 145 Palmer St., Pontiac, Mich.
8 BHS Clarence E. Dengler, 235 Bowen St. (Portable), Rochester, N. Y.
8 BID Allan Howe Smith, 1154 Cannon St., Syracuse, N. Y.
8 BIH Burdette Kimber, 62 Casterton St. (Portable), Akron, Ohio
8 BIZ Homer E. Zimmerman, 187 Dodge St., Akron, Ohio
8 BJE East Tech. High School, E. 55th and Scoville St., Cleveland, Ohio
8 BKF William M. Butler, 1011 Race St., Connellsville, Pa.
8 BKP F. W. Gallier, R. F. D. No. 1.....Cygnet, Ohio
8 BLJ Benedict French, 660 Elm St.....Buffalo, N. Y.
8 BLW Frederick V. Collins, 150 Puritan Ave. (Portable), Highland Park, Mich.
8 BLY Meade G. Pattington, R. F. D. No. 2, Aurora, N. Y.
8 BMH Wendell W. King, 28 2nd St. (Portable), Waterford, N. Y.
8 BNC Orson B Slocum, 17 Wagar Place.....Ionia, Mich.
8 BNM Copper City Radio Assn., 106 W. Liberty St., Rome, N. Y.
8 BOL Edward Davis, 456 Bellevue St.....Detroit, Mich.
8 BPE Andrew Noaker, 453 S. Church St., Bowling Green, Ohio
8 BRF Robert Cressp, 618 Parrish St., Uhrichsville, Ohio
8 BRJ Vincent S. Wagner, 604 Penn St..Sharpsburg, Pa.
8 BRS Eric W. & W. J. Colpus, 23 Henderson St., Pontiac, Mich.
8 BSD Philip Josslen, 302 S. Main St., Mechanicsville, N. Y.
8 BSE Anthony C. Badenkaye, 45 First West St., East Plymouth, Pa.
8 BSU C. S. Hoffman, Jr., 126 Chantal Court, Wheeling, W. Va.
8 BTC Roy E. Andrus, R. F. D. 2, Box 158, Ashtabula, Ohio
8 BUD McKeesport Y. M. C. A.....Indian Creek, Pa.
8 BVG Cyrus O. Caulton.....Woodbury, Pa.
8 BVJ Benjamin H. Saxton, 509 Cade St..Pittsburgh, Pa.
8 BVT Barnett H. Baskin, 1825 Brightwood Ave., Cleveland, Ohio
8 BWP Chris E. Hobson, Pittsburgh St....Connellsville, Pa.
8 BWU Lewis P. Cumie, 264 E. Hazelhurst St., Ferndale, Mich.
8 BXG Alfred K. Harvey.....Harvey's Lake, Pa.
8 BXU Walter F. Stinsman, 614 Hamlen St., Watertown, N. Y.
8 BZN Frederick A. Leonard, 922 Schoal St. Coraopolis, Pa.
8 BZS Carl W. Morton, R. F. D. No. 2, Steubenville, Ohio
8 BZT Gilbert M. Cooley, Nanerth Ave.....Dayton, Ohio
8 BZZ Walter H. Keller, 304 Harrison St., Syracuse, N. Y.
8 CAJ Rose Armstrong.....Benton, N. Y.
8 CAN Edward J. Trombley, 631 E. Fayette St., Saginaw, Mich.
8 CBZ Walter Buskist, South Main St., Cattaraugus, N. Y.
8 CCR Chester W. Steiner, 28 Charles St., Boonville, N. Y.
8 CDC John Taylor Galey, 303 Third St.....Beaver, Pa.
8 CDS Robert A. Karber, 2472 Garland Ave., Detroit, Mich.
8 CEY Burton A. Neil, 638 Lafayette Ave., Palmerton, Pa.
8 CFV Harold G. Towison, 30 Trinity Ave., Gouverneur, N. Y.

8 CHA Abraham Desterly, R. F. D. No. 4.....Irwin, Pa.
8 CJP Allen J. Pennybacker, 41 N. 3rd St., Cushocton, Ohio
8 CMU Ralph W. Tanner.....Lakeview, Ohio
8 COF Frank D. Fallain, Police Bldg., Beach St., Flint, Mich.
8 CPI John F. Davies, 62 Pierce St.....Kingston, Pa.
8 CQN Ralph A. Powers, 5138 Gratiot Ave., Port Huron, Mich.
8 CRF Harris C. Thomas & Leland W. Jones, 59 Pasadena Ave., Highland Park, Mich.
8 CSO Robert Lea .....Ashley, Ohio
8 CSY Haroldo W. Mank, 419 Clay Ave., Watertown, N. Y.
8 CTA Joseph B. Gardner, 4514 Whetsel St., Cincinnati, Ohio
8 CTQ Walter C. Olson, 103 Sturgis St., Jamestown, N. Y.
8 CVW Albert H. Hemenway.....Warsaw, N. Y.
8 CWW Milton L. Kuder, 139 W. 18th St.....Erie, Pa.
8 CXE David T. Davies, 111, R. R. No. 10, Box 73, W. Toledo, Ohio
8 CYC John B. Flores, 745 Lincoln Ave., Wilmington, Ohio
8 CZA John M. Van Cott, 7420 Warren Ave., E., Detroit, Mich.
8 DAG Orson B. Slocum, 4 State Rd. (Portable), Ionia, Mich.
8 DAZ William S. Fraser, 219 Centennial Ave., Sewickley, Pa.
8 DCR Harry S. Weber, 1113 Walnut St.....Dover, Ohio
8 DHI John C. P. Lewis, Main St.....Groton, N. Y.
8 DJT Ronald McGinnis, 1214 Faulkner St., Pittsburgh, Pa.
8 DKC Jas. A. Wilson, c/o Crescent Engraving Co., Kalamazoo, Mich.
8 DKO Gerald McGeorge, 1441 Belleview Blvd., Steubenville, Ohio

REASSIGNED CALLS

8 BT Glenn M. Luther, 807 Walnut St..Wilkinsburg, Pa.
8 SO Jos. G. Buehlmann, 73 Garfield St..Lancaster, N. Y.
8 AIZ Fred Glerspeck, 225 East Ave. W., E. Rochester, N. Y.
8 AMB Wayne Schaefer, 95 Highway St. (Portable), Battle Creek, Mich.
8 ANV Joel J. Young, 717 Gray St. (Portable), Elmira, N. Y.
8 AQA K. Walker Miles, 627 Pipestone St., Benton Harbor, Mich.
8 ATK Samuel W. Townsend (Portable).....Akron, Ohio
8 BAJ Raymond C. Gilbert, 502 Garfield St., E. Rochester, N. Y.
8 BEN Raymond H. Incia, 109 W. Chestnut St., E. Rochester, N. Y.
8 BGW Theo. J. Woodrow, 1650 S. Brown St., Dayton, Ohio
8 BHU Rexford Peters, Locust St.....Middleport, Ohio

NEW CALLS

8 DJP Gustave E. Sadlon, P. O. Box 131...Russellton, Pa.
8 DJQ Charles B. Sprague, 141 Jacob St...Penn Yan, N. Y.
8 DJR Sherwood P. French.....Barneveld, N. Y.
8 DJS Tremain M. Hughes, 534 Broadway....Oneida, N. Y.
8 DJT Ronald McGinnis, Oakvale, R. R. No. 3, Butler, Pa.
8 DJU Lester J. Hall, 83 W. First St.....Mansfield, Ohio
8 DJV Thomas Brain, 53 Sheridan St....Minners Mills, Pa.
8 DJW Wendell W. King, 26 Second St....Waterford, N. Y.
8 DJX L. Clifford White, 917 Dickie Ave., Parkersburg, W. Va.
8 DJY Ralph Atherton, Route No. 3.....Harrison, Ohio
8 DJZ Homer W. French, 819 Eureka St....Lansing, Mich.
8 DKA Leo Augustus, 416 Florence St.....Ypsilanti, Mich.
8 DKB Curtiss N. Lawter, 1106 Washington Ave., Huntington, W. Va.
8 DKC James A. Wilson, Osterhouts Resort, Gourdenach Lake, Mich.
8 DKD Geo. X. M. Collier, Forrest Ave....Frankfort, Mich.
8 DKE Howard E. Aller, 630 Catherine St..Syracuse, N. Y.
8 DKF William Webb, 2319 Hillside Place, Kalamazoo, Mich.
8 DKG James C. Moulton, 629 W. 9th St., Traverse City, Mich.
8 DKH Frank S. Wright.....North Fairfield, Ohio
8 DKI Nicholas G. Geracimos, 12 Hertyel St...Warren, Pa.
8 DKJ John F. Byrne, 728 E. Mound St....Columbus, Ohio
8 DKK Gerald R. Wright, 63 Marshall St..Coldwater, Mich.
8 DKL Russell A. Gray, 10 Clinton St.....Homer, N. Y.
8 DKM Ernest L. Griffiths, 873 N. Howard St., Akron, Ohio
8 DKN George M. Grady, 74 Pasemont Rd., Columbus, Ohio
8 DKO Gerald G. McGeorge, 1314 Ridge Ave., Coraopolis, Pa.
8 DKP Clarence E. Carpenter, 7 Champlain Ave., Whitehall, N. Y.
8 DKQ Donald L. Farrell, 327 Shonnard St., Syracuse, N. Y.
8 DKR LeRoy H. Goss.....Beach Haven, Pa.
8 DKS Edgar R. Vincent, 25 Middle St.....Uniontown, Pa.
8 DKT Wilson E. Rowell, 23 Oneida St., Baldwinsville, N. Y.
8 DKU Henry W. Wickenhiser, 1112 State St., Coraopolis, Pa.
8 DKV Stanley Kime .....North Fairfield, Ohio
8 DKW H. Morris Ervin, 506 S. St. Clair St., Painesville, Ohio
8 DKX Robert M. Ferry, 62 North St....Binghamton, N. Y.
8 DKY Nelson L. Stoll, 235 Mulberry St....Buffalo, N. Y.
8 DKZ Nelson Griswold, 1125 Miller St.....Utica, N. Y.
8 DLA Allen W. Blanchard, 75 E. Tompkins St., Columbus, Ohio
8 DLB Leroy M. Gunniss, Water St.....Algonac, Mich.
8 DLC Chancy F. Whitney, 502 W. Cross St., Ypsilanti, Mich.
8 DLD Stuart E. Chipman, 708 Maple St., Battle Creek, Mich.
8 DLE Neal P. Merrill, Clay and Michigan Sts., Algonac, Mich.
8 DLF James England (Antioch College), Yellow Springs, Ohio
8 DLG Seth H. Neddermeyer.....Richmond, Mich.
8 DLH Kenneth B. Houston, 432 Holt St.....Dayton, Ohio
8 DLI Orin S. Parker .....Saugatuck, Mich.
8 DLJ Carl A. Pilkington .....Portland, Mich.
8 DLK Arthur E. Byerlein, 2409 Maplewood St., Toledo, Ohio
8 DLL Ronald C. Schall .....Luther, Mich.
8 DLM Evert Johnson .....Rochester, Mich.
8 DLN Berla M. Dysinger, 822 Maple Ave.....Findlay, Ohio
8 DLO Roy E. Williams, Commerce St.....Milford, Mich.
8 DLP Almaron Ketzler, 1054 Oak St.....Flint, Mich.
8 DLQ Howard A. Walker, 1312 Beach St.....Flint, Mich.
8 DLR Loys L. Hotchkiss, Sheldon R. Pratt, 1040 Jefferson St., Scranton, Pa.
8 DLS Francis Jennings 2221 Whitney St.....Toledo, Ohio
8 DLT Milford W. Howe, 9 Judson St. (Portable), Canton, N. Y.

CHANGES OF ADDRESS

8 CF Chas. H. Katzenberger, 124 W. Main St., Greenville, Ohio
8 HE Ralph Gaylord, 73 N. Front St., Cuyahoga Falls, Ohio
8 KC Werner K. Sauber, 14300 Strathmore Ave., E. Cleveland, Ohio
8 OB Herbert F. Kelso, 815 Euclid Ave...Dravosburg, Pa.
8 TN Harry L. Wadsworth, 501 8th St....Charleroi, Pa.
8 TX Earl Schwenger, 9611 Houch Ave....Cleveland, Ohio
8 ACT Fred E. Welsh, 94 Long Ave.....Hamburg, N. Y.
8 AEC Harold J. Perkins, 166 Boardman St...Elmira, N. Y.
8 AJT Philip Schwartz, 6215 Belvidere Ave., Cleveland, Ohio
8 ALX Roy C. Burns, 908 Briar Ave., Washington C. H., Ohio
8 AUZ Edward Brandt, 3568 Fulton Rd.....Cleveland, Ohio
8 AWX Victor D. Gettys .....Warren, Ohio
8 BCX Harold C. Urschel.....Bowling Green, Ohio
8 BFU Ernest E. Stratton .....Capac, Mich.
8 BFV Raymond Mills, 1513 Riverview Drive, Endicott, N. Y.
8 BGV Lewis E. Springer, 5 E. Genesee Rd...Auburn, N. Y.
8 BHL Oka V. Swisher, Paw Paw Ave...Riversville, W. Va.
8 BQZ Paul Bliss, Harmon Park....Ashtabula Harbor, Ohio
8 BRZ James L. Russell, 1862 E. 101st St., Cleveland, Ohio
8 BYY Fred A. Lankton, 829 Westmoreland Ave., Lansing, Mich.
8 CGO Lewis E. Marks, 102 N. Market St., E. Palestine, Ohio
8 CLI Alton D. Kunkel, 572 E. Main St.....Bradford, Pa.
8 COA Rudolph G. Miller, 21 Bristol St..Canandaigua, N. Y.
8 DAO Roy E. Urban, 13905 Shaw Ave...E. Cleveland, Ohio
8 DAW Russell B. Whitehurst .....Sycamore, Ohio

Ninth District

9 IO Charles Middleton, 719 Michigan Ave., LaPorte, Ind.
9 IB Fred A. Schaefer, 744 53d St., Milwaukee, Wisc.
9 IS Gus D. Haedecke, 1455 Celveland Ave., St. Paul, Minn.
9 IT Edward A. Holm, 2711 Sayre Ave., Chicago, Ill.
9 IW W. H. Webb, 412 E. Lyon St.....Lyons, Kans.
9 JC James A. Crowdus, 10496 Riverview Drive, St. Louis, Mo.
9 JF Irwin Ogden, 403 Prospect St. ....Red Oak, Iowa
9 JM George Gabert, 654 N. Cedar St., Sturgeon Bay, Wisc.
9 KS Lester Christofferson, 114 60th Ave., W., Duluth, Minn.
9 MK Ralph G. Carpenter, 814 McPherson St., Alton, Ill.
9 NA W. J. Connelly, 414 S. W. Blvd., Kansas City, Kans.
9 NL James W. Knowland, 1122 Greeley St., Kansas City, Kans.
9 NM Harvey A. Stone, R.F.D.....Quinn, S. Dak.
9 NP Earl W Reiss .....O'Fallon, Ill.
9 NT Roger H. Radabaugh, 4132 29th Ave., S., Minneapolis, Minn.
9 RD Vernon L. Ferguson, 315 N. E. Park St., Luverne, Minn.
9 SP Lloyd L. Rounds .....Mott, N. Dak.
9 TA Oral H. White, 699 Adam St. ....Franklin, Ind.
9 TC George P. Dunklau, 7230 Yates Ave., Chicago, Ill.
9 TG Robert J. Pickhardt, 98 Home Ave., Franklin, Ind.
9 VF Neal D. Brigham, 46 N. Chester Ave., Indianapolis, Ind.
9 AAF Theo. Pentzoid, 440 Tamarack St., Laurium, Mich.
9 AAO George H. Guett, 3406 Woodlawn Ave., Kansas City, Mo.
9 ABE John O. Weaver, 428 Tonti St. .....LaSalle, Ill.
9 ACX Glenwood Radio Club, 920 N. Fifth Ave. Minneapolis, Minn.
9 ADP John B. Catlin, 490 Rankin St., Appleton, Wisc.
9 AIW Fred Marshall, 512 Eighth St., N...Fredonia, Kans.
9 AJC Edwin N. Ebeling .....Atwood, Kans.
9 ALA Harry E. White, Jr., 2529 Hall Ave., Marinette, Wisc.
9 ALD Edgar F. Johnson .....Waseca, Minn.
9 ALI LeRoy D. Jordan, P. O. Box No. 55, Riverville, Wisc.
9 AMB Jarrett L. Hathaway, 4026 E. 19th St., Denver, Colo.
9 AOK Mertin Reeves, No. 8 East 53d Terrace, Kansas City, Mo.
9 AQG Milton Adams, 4352 Aldrich Ave., S., Minneapolis, Minn.
9 ARB Paul Ward, 710 W. Prospect St. ....Kewanee, Ill.
9 ARL Louis B. Van Orman, R. F. D.....Hardy, Nebr.
9 ARY Rollin B Posey, 1315 New Hampshire St., Lawrence, Kans.
9 ANN Raymond J. Wirtel, 4730 Ashland Ave., St. Louis, Mo.
9 ANY Len E. Webster, 401 W. 19th St., University Place, Nebr.
9 ATL Joe Brier, Jr. .....DeWitt, Nebr.
9 ATU Benjamin F. Sherman, 204 W. Mackie St., Beaver Dam, Wisc.
9 AUH Philip Miller, 800 Joliet St.....Joliet, Ill.
9 AVT Ralph W. Eckley, R.F.D. No. 2 .....Ollie, Iowa
9 AWP Robert L. Coe, 455 W. Swan Ave., Webster Groves, Mo.
9 AXH Robert E. Stuart, 4130 N. Meridian St., Indianapolis, Ind.
9 BDQ Earle Hanson, 1006 Reaney St. ....St. Paul, Minn.
9 BDX Harvey White, R.F.D. No. 1 ....Farmersville, Ill.
9 BEE Milan McCandless, 1600 Madison Ave., Council, Bluffs, Iowa
9 BEK Raymond E. Swain, 2328 Highland Place, Indianapolis, Ind.
9 BEP Howard Kelly, 1215½ Nicollet Ave., Minneapolis, Minn.
9 BET Roy C. Pasley, 306a Poynts Ave., Manhattan, Kans.
9 BEU Walter Birdsall, 228 Third St. ....Longmont, Colo.
9 BEW Joseph A. Umhoefer .....Anthon, Iowa
9 BEX James W. Copeland, 3417 Holmes Ave., Minneapolis, Minn.
9 BEZ William Obrist, 302 Gilman Ave. ....Wichita, Kans.
9 BFA John R. True, 401 E. Second St.....Kewanee, Ill.
9 BFB John R. Hinegardner .....Toledo, Iowa
9 BFI Leon A. Mears, 4511 S. Colfax Ave., Minneapolis, Minn.
9 BFK John P. Czarnecki, 417 Rogers St., Milwaukee, Wisc.
9 BFP Robert E. Whitmer, 506 S. Osage Ave., St. Louis, Mo.
9 BFR Norval R. Haubart, 5125 N. Market St., Norbert E. Jolliffe, 201 12th St.....Muncie, Ind.
9 BFS Walter C. Nelson .....Walhalla, N. Dak.
9 BFW William Conway, 705 E. Wood St., Waseca, Minn.
9 BGU Clarence R. Armour, 909 E. First St., Ft. Scott, Kans.
9 BHA Cameron R. Patterson, 1616 New Hampshire St., Lawrence, Kans.
9 BHK Lawrence A. Nelson, 194 Cedar St., Wauwatosa, Wisc.
9 BHM Charles M. Duncan, 4309 N. Lincoln St., Chicago, Ill.
9 BHO Don W. Short, 1696 West 3rd St., Dubuque, Iowa
9 BHS John F. Smith, ...Lorimor, Iowa
9 BHT Carlott Gilbertson.....Hickson, N. Dak.
9 BHU Fred L. Schirk, 1171 Detroit.....Denver, Colo.
9 BIC Forrest E. Curnutt, 136 W. First St., Garnett, Kans.
9 BID Richard W. Billett, 922 Sheridan Ave., N., Minneapolis, Minn.
9 BIS Frederick J. Hercher, 3117 N. St. Louis Ave., Chicago, Ill.
9 BIU Robert C. Klimesh .....Spillville, Iowa
9 BIV Guy Crawford, Jr., 513 W. 6th St., Mt. Carmel, Ill.
9 BIJ Russell H. Schmitz, Franklin St., Manchester, Iowa
9 BJW Harry P. Todd, 1015 N. 6th St. ...Springfield, Ill.
9 BKH John M. Meyer, 888 44th St. ...Milwaukee, Wisc.
9 BKR William S. Jordre .....White Bear Lake, Minn.
9 BKU Ellsworth W. Swedlen, 3811 S. Eleventh Ave., Minneapolis, Minn.
9 BKY George E. Weina .....Niobrara, Nebr.
9 BKZ Ralph E. Baldwin, Avondale Stock Farm, Farson, Iowa
9 BLA William R. Selleck, 715 Hillside Ave., Glen Ellyn, Ill.
9 BLJ Myer Podolor, 1910 Fremont Ave., N., Minneapolis, Minn.
9 BLL Kenneth B. Lucas, 2725 Dupont Ave., S., Minneapolis, Minn.
9 BLV George P. Self, 634 Capitol Blvd. ....St. Paul, Minn.
9 BLX Fred J. Mueller, 1827 Fulton St. ....St. Paul, Minn.
9 BMB Arthur C. Mickey.....Port, Ill.
9 BMH Russell W. Groth, 2100 Bradley Place, Chicago, Ill.
9 BMO Marvin Nelson, 2318 Douglas St.....Omaha, Nebr.
9 BMP H. E. Keller and V. E. Kranitz, 142 South St., Milwaukee, Wis.
9 BMV Leonard W. Still, 1136 E. Geranium St., Milwaukee, Wis.
9 BMX Philip D. Zurian, 2346 Talmadge St., Madison, Wisc.
9 BNF Paul H. Thomsen, 316 West Brown St., Lancaster, Minn.
9 BNG Lester Roberts, 316 S. Pennsylvania St., Denver, Colo.
9 BNJ Elmer W. Teagarden, 2918 Galyord St., Denver, Colo.
9 BNL Earl and Clyde Scheppele, 2951 Washington St., Dubuque, Iowa
9 BNN Willaim Hollerbach, 1540 N. Linden Ave., Chicago, Ill.
9 BNO William A. Snyder, 308 Carlysle Ave., Ashtabula, O.
9 BNQ Ivan Boyd, 634 Prairie Ave.....Creston, Iowa
9 BNT Kenneth W. Anderson, 410 N. Oak St., Creston, Iowa
9 BNX Gifford S. Babcock .....Clifton, Ill.
9 BNY Waldo M. Wilson, 815 9th Ave., Brookings, S. Dak.
9 BOB Philip M. Gundlach, Gundlach Place R. R. No. 1, Wabash, Kans.
9 BOD Kenneth A. Roberts .....Bovey, Minn.
9 BOJ Carl E. Mosley, 207 East Ave. .....Ames, Iowa
9 BOW W. Keith Miller, 924 S. 20th St., Lincoln, Nebr.
9 BOX Herman E. Lacy, 419 Webster St. ...Chicago, Ill.
9 BOY Robert Heuberger, 846 Wisconsin St. ...Oak Park, Ill.
9 BPF Frank J. Mossbrugger, 175 W. Isabel St., St. Paul, Minn.
9 BPK Egbert W. Vander Linden, R. No. 2, Des Moines, Iowa
9 BPL William N. Parker, 2555 Argyle St., Chicago, Ill.
9 BPM Orestes A. Kincaid, 1211 Sunnyside Ave., Chicago, Ill.
9 BPR George L. Starkey, College Campus....Ames, Iowa
9 BPU Leland S. Jett, 434 Laurel Ave. ....St. Paul, Minn.
9 BQA Randolph G. Lanning, 116 Lake St., Oak Park, Ill.
9 BQC Karl E. Pierson, 2453 Brighton Ave., Kansas City, Mo.
9 BQH Jerry W. Hill.....Milton, Wis.
9 BQJ Adrian J. Ivens, 1222 James Ave., N., Minneapolis, Minn.
9 BQK Charles C. Proudfit, 840 W. Third St., Des Moines, Iowa
9 BQL Orvill F. Smith .....Portland, N. Dak.
9 BQN Oliver W. Morton, Jr., 139 N. Dunlap St., St. Paul, Minn.
9 BQS Edward F. Tindall, 822 E. Third St., Maryville, Mo.
9 BQV Robert C. Deigert, Coronado Apts., 232 and Capitol Ave., Omaha, Nebr.
9 BQY Rudolph Sturm, 1869 Minnehaha St., W., St. Paul, Minn.
9 BRF Robert W. Nelson, 407 E. First St., Hutchinson, Kans.
9 BRL Paul W. Andrew .....Elfield, Iowa
9 BRM John Battram, 316 N. Main St., Oakland City, Ind.
9 BRU Lyman C. Fisher, R. R. No. 5, Box 109, Marion, Ind.
9 BRW Arthur H. Poshlman .....Keokuk, Ia.
9 BSC Edwin G. Moutoux, 1111 Louisiana St., East, Evansville, Ind.
9 BSJ Donald D. Beachler .....Bowley, Iowa
9 BSK Charles N. Short, R.F.D. No. 4, Wessington Springs, S. Dak.
9 BSM James W. Cannon 42 E. Main St., Chicago Heights, Ill.
9 BSN Herman J. Wise, 401 N. Stewart St., Rolla, Mo.
9 BSP Marshall H. Ensor R.F.D. No. 4, Box 39, Olathe, Kans.
9 BUY Clifford W. Johnson, 310 S. Silver St., Pauls, Kans.
9 CEO Caleb T. Gustafson, 1506 Carney Blvd., Marinette, Wis.
9 CRL G. C. Wallace and A. J. Losinski, 2546 Taylor St., Minneapolis, Minn.
9 CYT Grover S. Dale, 49 Third St., N. W., Linton, Ind.
9 EDD Phil Davis, 6033 Suburban Ave... St. Louis, Mo.

CHANGES

9 AIO Vance L. Miller 1415 Lexington Ave., Laurenceville, Ind.
9 ALZ Dale Fouts .....Glen Carbon, Ill.
9 AMB Jarrett L. Hathaway, 4026 E. 19th St., Denver, Colo.
9 BDL Kendall M. North, 5331 Winthrop Ave., Chicago, Ill.
9 BIZ Howard Powers, 309 S. Pleasant St., Princeton, Ill.
9 BNC Robert F. Adams, 490 Anthony St., Glen Ellyn, Ill.
9 CEE Horace J. Cornitius, 5835 Kingsbury Blvd., St. Louis, Mo.
9 CSK Harry G. Crofts.....Carrier Mills, Ill.
9 DGM Ivan H. Anderson, No. 811 14th Ave., S., Minneapolis, Minn.
9 DGN Nathan Lupu, 2641 Hennepin Ave., Minneapolis, Minn.
9 DOM Phil Konkie, 309 E. Green St. ....Winterset, Iowa
9 DPS Clarence C. Ennes, 4448 N. Tripp Ave., Chicago, Ill.
9 DTY Edwin L. Eldredge, 2258 Logan Blvd., Chicago, Ill.
9 CC Coe College, 1st Ave. and 12th St., Cedar Rapids, Iowa
9 LD Herman B. Schenke, 1001 W. 9th St., Alma, Ill.
9 LM Burton E. Bodine, 7000 Virginia Ave., St. Louis, Mo.
9 LO Albert G. Olson.....Ames, Ia.
9 LP Edward L. Sheperd, 4522 Delmar Blvd., St. Louis, Mo.
9 MM Masonic Radio Club.....Converse, Ind.
9 MV John R. James.....Story City, Iowa
9 SC Philip H. Weber, Y. M. C. A., 4th and Wisconsin Sts., Racine, Wis.
9 SD Frank C. Casey, Eastern Ave.....Marenco, Iowa
9 SK Charles M. Mitchell, Lafayette Ave., Emerson, Iowa
9 SE M. B. Lowe, 2622 Hamsden Court Ave., Chicago, Ill.
9 TH Earl and William Engelbretson, 419 Livingston Ave., St. Paul, Minn.
9 UB Herbert E. Harrison, 403 E. Gilmore St., Augusta, Ky.
9 UX Harry E. Thompson.....Warner, S. Dak.
9 UZ Charles W. Kleman, 39 Greenbrier Rd., Covington, Ky.
9 VC William F. Evans, 2173 Hillside Ave., Indianapolis, Ind.
9 WB Lewis K. Gerkey, 1630 Jackson Ave., Kansas City, Mo.
9 WG Chester V. Entriken, 419 Greeley Ave., Kansas City, Kans.
9 WI Lewis C. Meek.....Ellsworth, Iowa
9 WJ Herman Van Allen, 6713 Michigan St., St. Louis, Mo.
9 WO Huntington Publishing Co., 32 Washington St., Huntington, Ind.
9 WU Edward G. Hill, 1330 First St., S., Louisville, Ky.
9 WY A. L. Bickhard, 346 Fredrick St., Huntington, Ind.
9 WZ Ralph Heiberg, 23 W. Grant St., Minneapolis, Minn.
9 AEW Rockford High School Radio Club, S. Madison St., Rockford, Ill.

PARAGON

Read This Letter To Wireless Age

HOWARD ADAMS, JR.
VA. MD. COAL CORP.
SHINNSTON. W. VA.

June 17, 1923.

Editor WIRELESS AGE,
326 Broadway, N. Y. C.

Dear Sir:

I am enclosing a list of stations heard at Shinnston, W. Va., using a PARAGON RA-10 tuner WITH DETECTOR AND TWO-STEP AUDIO AMPLIFIER.

I consider this a very good list and if you care to publish the same you may do so.

There will undoubtedly be some people who will question the fact that I include Brazil and England in the list, but I can swear to the correctness of this list. All stations were heard on a Magnavox loud-speaker and with enough volume to be heard all over a fair sized room. I have not listed stations under 150 miles, but I have received at least five which are within that distance.

I think the distances are correct or as near correct as possible.

I am very proud of this list and if there is anyone who questions the truth about receiving such distant stations I should like to hear from them.

I would like to congratulate you on your fine magazine, as I think it the best radio journal in existence. I remain,

Very truly yours,

Howard Adams Jr.

Stations Heard at Shinnston, W. Va., By Howard Adams, Jr.

Station Call	Location	Distance in Miles
WHAS	Louisville, Ky.	300
KYW	Chicago, Ill.	425
WMC	Memphis, Tenn.	600
WSB	Atlanta, Ga.	450
WWJ	Detroit, Mich.	250
WGM	Atlanta, Ga.	600
WDPA	Chicago, Ill.	425
WJZ	Newark, N. J.	350
WJZ	New York, N. Y.	350
WOR	Newark, N. J.	350
WIP	Philadelphia, Pa.	300
KSD	St. Louis, Mo.	550
WOC	Davenport, Ia.	575
WDAF	Kansas City, Mo.	775
WEAF	New York, N. Y.	350
WGR	Buffalo, N. Y.	275
WLW	Cincinnati, O.	225
WLK	Indianapolis, Ind.	300
NAA	Arlington, Va.	175
WGY	Schenectady, N. Y.	423
WHAZ	Troy, N. Y.	425
WHA	Madison, Wis.	550
WBZ	Springfield, Mass.	450
CKAC	Montreal, Canada	575
KOA	Denver, Colo.	1,325
WKY	Oklahoma City, Okla.	1,025
WGI	Medford Hillside, Mass.	550
CFCN	Calgary, Canada	2,000
WDAL	Jacksonville, Fla.	625
WGAL	Lancaster, Pa.	225
WEAV	Rushville, Neb.	1,200
WCAL	Northfield, Minn.	775
KFAF	Denver, Colo.	1,325
KDYX	HONOLULU, T. H.	4,600
WGF	Des Moines, Ia.	725
WHAH	Joplin, Mo.	700
CHXC	Ottawa, Canada	500
KOP	Detroit, Mich.	250
WAAC	New Orleans, La.	875
WDAK	Hartford, Conn.	425
WCAY	Milwaukee, Wis.	485
WDAR	Philadelphia, Pa.	300
KGG	Portland, Ore.	2,250
WJY	New York, N. Y.	350
WMAC	Cazenovia, N. Y.	350
KGW	Portland, Ore.	2,250
KPO	San Francisco, Cal	2,350
WLAY	FAIRBANKS, ALASKA	3,500
KLB	Pasadena, Cal.	2,175
KFBV	Colorado Springs, Colo.	1,325
WWI	Dearborn, Mich.	275
WNAC	Boston, Mass.	525
WBAP	Fort Worth, Tex.	1,075
WMAQ	Chicago, Ill.	425
WJAX	Cleveland, Ohio	175
WEAR	Baltimore, Md.	200
WEAM	North Plainfield, N. J.	275
WBAD	Minneapolis, Minn.	775
WLAG	Minneapolis, Minn.	775
WHB	Kansas City, Mo.	775
WOS	Jefferson City, Mo.	650
WLB	Minneapolis, Minn.	775
WIAO	Milwaukee, Wis.	485
2XB	New York, N. Y.	350
WHAM	Rochester, N. Y.	300
WDAJ	College Park, Ga.	475
WSY	Birmingham, Ala	550
CHYC	Montreal, Canada	575
WSM	Norfolk, Va.	275
WIAR	Paducah, Ky.	500
WBAV	Columbus, Ohio	150
WOAT	Wilmington, Del.	250
WMU	Washington, D. C.	175
WWX	Washington, D. C.	175
WJH	Washington, D. C.	175
KGU	HONOLULU, T. H.	4,600
WJAN	Peoria, Ill.	510
WHX	Des Moines, Ia.	725
WMAF	Dartmouth, Mass.	500
WHAL	Lansing, Mich.	325
WRAO	St. Louis, Mo.	550
WCK	St. Louis, Mo.	550
KDYS	Great Falls, Mont.	1,675
WOAW	Omaha, Neb.	850
WHK	Cleveland, Ohio	175
WDH	Indianapolis, Ind.	310
WHN	Ridgewood, N. Y.	350
WEAO	Columbus, Ohio	150
WGL	Philadelphia, Pa.	300
WWAD	Philadelphia, Pa.	300
WEAN	Providence, R. I.	510
WJAR	Providence, R. I.	510
WCAR	San Antonio, Tex.	1,275
KZN	Salt Lake City, Utah	1,675
SPC	RIO DE JANEIRO, BRAZIL	5,000
CHCF	Winnipeg, Canada	1,150
WBAN	Paterson, N. J.	325
WEAS	Washington, D. C.	175
PWX	Havana, Cuba	1,400
5KW	Tuinucu, Cuba	1,400
WEAD	Atwood, Kansas	1,150
WFAA	Dallas, Tex.	1,050
WAAP	Wichita, Kanas.	950
CFCA	Toronto, Canada	310
2LO	LONDON, ENGLAND	3,100
WLAZ	Warren, O.	150
WFI	Philadelphia, Pa.	300
WBT	Charlotte, N. C.	300
WOO	Philadelphia, Pa.	300
WOAI	San Antonio, Tex.	1,275
WAAH	St. Paul, Minn.	775
WCX	Detroit, Mich.	250
KWH	Los Angeles, Cal.	2,200
KFI	Los Angeles, Cal.	2,200
WOAN	Lawrenceburg, Tenn.	400
WLAK	Bellows Falls, Vt.	500
CFCF	Montreal, Canada	575
WKAQ	San Juan, Porto Rico	1,400
WJAZ	Chicago, Ill.	425
WAAM	Newark, N. J.	350
WOI	Ames, Ia.	750
CHBC	Calgary, Canada	2,000
WCAU	Philadelphia, Pa.	300
KFEC	Portland, Ore.	2,250

An illustrated Catalog of Paragon Radio Products is Yours for the Asking

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A Long Distance Wonder-Worker With Remarkable Selectivity

THE "Midget" marks a distinct forward-step in radio engineering.

Tho' small in size and low in price, it gives the radio lover a remarkably wide distance-area and wave-length range. Its power to tune **out** assertive local stations, in favor of more distant broadcasting is widely appreciated. Or, if desired, local broadcasting is received clean, clear, free from interference of all kinds.

Ideal for summer tourists and campers because of its light weight, convenient portability and power to combat summer static. Yet is an efficient year-round instrument for the home. Handsome mahogany finished cabinet 14¼ in. long, 7⅞ in. high, 9⅝ in. deep at base.

Operates with any of the dry cell tubes as well as with standard 6-volt tubes. Cabinet will hold three No. 6 dry cells and 22-volt "B" Battery.

Levers in place of dials makes tuning easier and accurate. Wonderfully clear, pure-toned reception through head phones—add two-stage amplifier for loud speaker reception.

Price without tubes or batteries, F.O.B. Grand Rapids, $27.00.

ALSO investigate the **Michigan "Senior"** and **Michigan "Junior"** Regenerative Receivers, licensed under Armstrong U. S. Patent 1,113,149 and pending Letters Patent 807,388. They are equipped with the now famous Michigan Split Hair Vernier Dial Adjuster.

Or, if you wish to amplify your present receiver for loud speaker reception, send for the Michigan **Two-stage Amplifier** unit.

If building your own set, send for circular describing Michigan Variometers, Variocouplers, Plate and Grid Condensers, Vernier Rheostats, Potentiometers, All-Range Couplers, etc., etc.

Dealers: Ask for full information on the MRC Exclusive Franchise Plan—that will put you in **control** of local radio business.

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